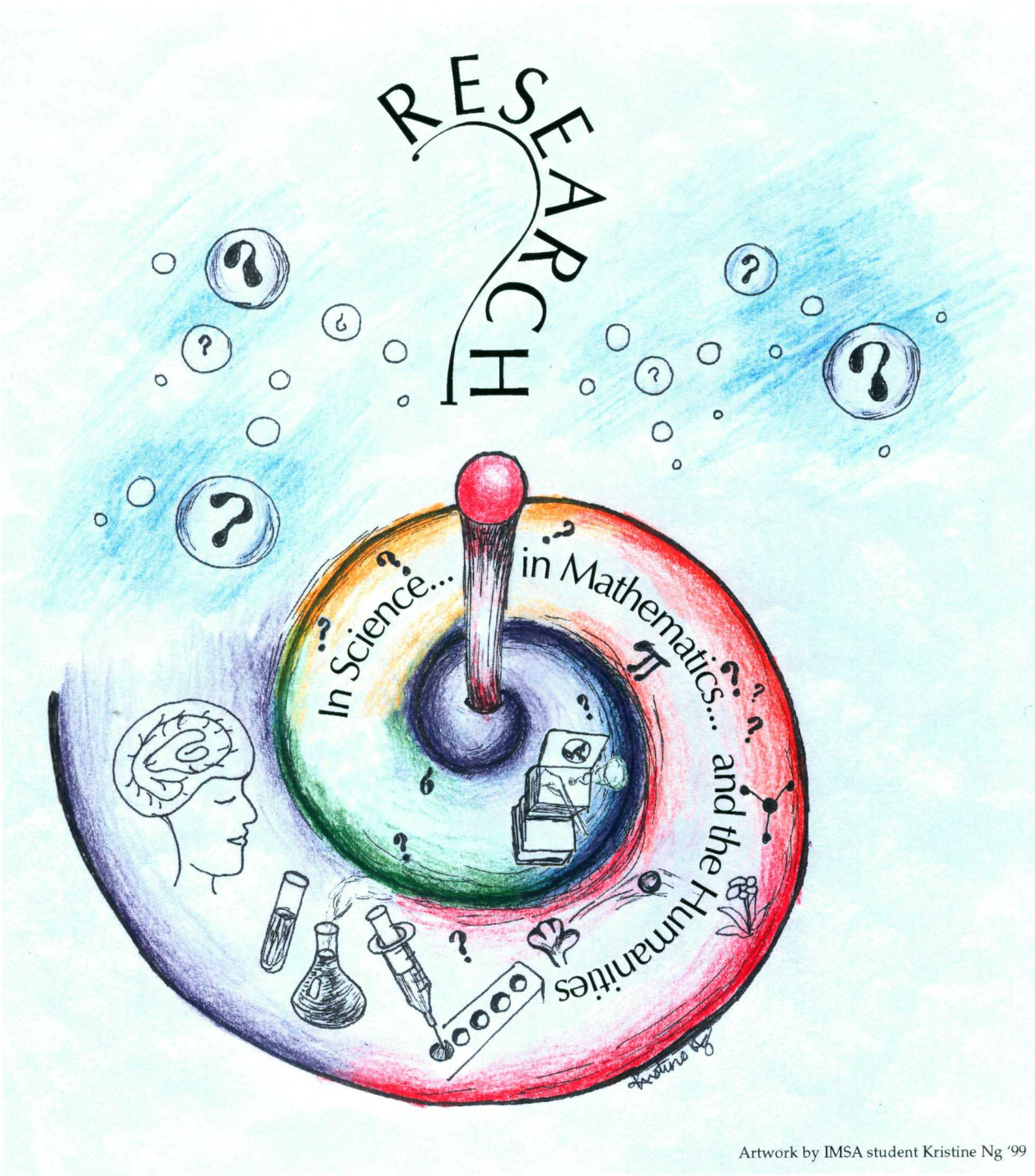

Artwork by IMSA student Kristine Ng '99

Tenth Annual IMSA Presentation Day

April 29th, 1998

IMSA

Illinois Mathematics and Science Academy

IMSA

Illinois Mathematics and Science Academy

"A Pioneering Educational Community"

Student Research and Inquiry Program

Research is the fundamental activity of science. By engaging in authentic research, one can better appreciate the concepts and theories underlying science and discover new pathways for improving the human condition.

At the Illinois Mathematics and Science Academy, student research serves as a foundational underpinning of the academic program. The Student Research and Inquiry Program at IMSA supports the development of students as highly skilled and integrative problem finders, problem solvers, and apprentice investigators. The program provides learning experiences for students to pursue compelling questions of interest, conduct original research in science and other fields, create and invent products and services, share their work through presentations and publications, and collaborate with other students, mentors, scholars, researchers and inventors throughout the world. At the Academy these experiences are provided in courses, a mentorship program, independent study, individual student plans of inquiry that are a requirement for graduation and selected co-curricular activities.

Opportunities for Academy students to do real-world "hands-on" research have been available at the Academy since 1988 through the IMSA student Mentorship Program. This learning opportunity provided to IMSA students has grown from 24 students in 1989 to over 140 in 1997.

The Academy's commitment to creating "decidedly-different learners" comes directly from the Academy's mission as a pioneering educational community. To that end, IMSA has worked to create fluid, flexible learning environments that allow students to learn as apprentice investigators and develop the problem finding and solving skills that will be required to compete successfully in the global workplace of the 21st century.

Each Wednesday of the academic year approximately 130 students leave campus (while others pursue research on campus) to engage in formal research with master scholars and scientists in educational institutions, corporations and laboratories throughout the greater Chicago area. Research is conducted in a variety of disciplines, reflecting the student's passion for a particular student and the mentors expertise. Students document their research in lab notebooks; many subsequently present their research in local, national and international research forums, state and national competitions (Westinghouse competition) and juried scholarly journals.

(continued on next page)

IMSA students have been invited to present at nationally and internationally recognized research conferences.

Examples include:

- Having the only high school age students invited to present at the prestigious National Conference on Undergraduate Research at the University of Minnesota.
- Four students invited by the Russia Academy of Science to present at the Sakharov Readings in St. Petersburg Russia in 1996.
- 17 students selected to present at the 1997 and 1998 American Association for the Advancement of Science national conferences in Seattle, Washington and Philadelphia, Pennsylvania.
- Two members of the IMSA Class of 1997 presented their mentorship research involving transplantation of ostrich organs both nationally and internationally in France, England and The Johns Hopkins University.

The 1998 IMSA Student Presentation Day featured 96 student research presentations with topic ranging from *Estrogen Regulation of MCP-1 Levels in Dermal Wound Healing* to *Effects of Varied Electromagnetic Fields at 60Hz in the Regulation of the Multidrug Resistance Gene in T-Lymphocytic Human Leukemia Cells.* This booklet features a complete listing of presentations and abstracts of student research during the 1997-98 academic year.

For additional information about the Student Research and Inquiry Program contact Ted Parge, Vice President of Institutional Advancement. (630)907-5040.

"You can't really measure the power of an idea."
Dr. Leon Lederman, Nobel Laureate and IMSA Founder

ILLINOIS MATHEMATICS AND SCIENCE ACADEMY

"A Pioneering Educational Community"

TENTH ANNUAL IMSA PRESENTATION DAY
APRIL 29, 1998

Abstracts can be found attached in alphabetical order under the first presenter.

Auditorium

10:10 - 10:25 THE ROLE OF THE UNITED NATIONS IN THE CURRENT WORLD SITUATION
Eric Syu

10:35 - 10:50 EXHIBITION OF ORIGINAL STUDENT MUSICAL COMPOSITION
Mark Ciaccio, Sarah Moss, Mark Running

Academic Pit

8:30 - 9:35 THE STARVED ROCK PROJECT: UNE CANNOT DU BOIS
Robert Asumendi, Gwen Blume, Michael Chang, Paul Guilianelli, Jacob Hesterman, Katja Meyer, Pearl Phaovisaid, Virginia Ryan, Jacob Trevick, Dr. Clay Skinner

9:45 - 10:00 STARVED ROCK PROJECT
Jeremy Best, Dr. Clay Skinner

10:35 - 10:50 EVIL AND THE INVERSION OF NATURAL ORDER IN SHAKESPEARE'S MACBETH
David Crane, Dr. Riva Kuhl

A-110

8:30 - 8:45 NEUROMODULATION OF CYTOKINE SYNTHESIS BY T-HELPER CELLS
Andrew Torres, Virginia M. Sanders, Raymond A. Baker, Deborah J. Kasprowicz, Adam Kohm, Michelle Swanson

8:55 - 9:10 ALTERATIONS AND ENHANCEMENT OF ANGIOGENSIS IN HEALING WOUNDS
David Nopachai, Aime Burns, M.S., Luisa A. DiPietro, DDS, Ph.D, Quentin Low, Mari Swift

9:20 - 9:35 INVESTIGATION OF LOW-MOLECULAR WEIGHT HEPARINS AS POTENTIAL SUBSTITUTE DRUGS FOR HEPARIN IN HEPARIN-INDUCED THROMBOCYTOPENIA
Pavan Brahmamdam, Jennifer Wood, Walter Jeske, Ph.D., Jeanine M. Walenga, Ph.D.

9:45 - 10:00 EFFECTS OF TRANSFORMING GROWTH FACTOR β (TGFβ) ON RECOMBINATION-ACTIVATING GENES (RAG) FUNCTION IN HUMAN T-CELL MATURATION
Stephanie C. Manson, Dr. Phong T. Le, Ph.D.

10:10 - 10:25 IMMUNO PEROXIDASE STAINING FOR THE DETECTION OF ANTIBODIES AGAINST THE SV40 T-ANTIGEN
Adrianna Zhang, M. Carbone, M.D., Ph.D., P. Rizzo

10:35 - 10:50 A COMPARATIVE STUDY OF CYTOKINES INVOLVED IN B- LYMPHOPOIESIS IN AGED AND YOUNG MICE
Abidemi Adeboje, Dr. Pamela Witte

11:00 - 11:15 OSTEOGENIC PROTEIN-1 AND INTERLEUKIN-1 ON ADULT BOVINE CHONDROCYTES CULTURED IN ALGINATE
Angel Alvarez, Dr. Koichi Masuda

A-112

8:30 - 8:45 OVARIAN AUTOIMMUNITY AND POLYCYSTIC OVARY SYNDROME (PCOS)
Peter Adamczyk, Dr. Judith Luborsky, Brainard Llanes

8:55 - 9:10 ANALYSIS OF OVARIAN AND HUMAN CHORIONIC GONADOTROPIN (hCG) ANTIBODIES IN WOMEN WITH RECURRENT SPONTANEOUS ABORTION
Jacqueline McKenna, Dr. Judith Luborsky, Brainard Llanes

9:20 - 9:35 SITE -DIRECTED MUTAGENESIS OF S100ß PROTEIN: A STRUCTURE-FUNCTION STUDY OF ITS ROLE IN ALZHEIMER'S DISEASE
Soumiya Prakasam, Linda Van Eldik, Beth Herbert, Edith Turkington

9:45 - 10:00 DETECTION OF MYOSIN LIGHT CHAIN IN MOUSE HEART OUTGROWTHS AND FGFR3 IN MOUSE BLASTOCYST OUTGROWTHS USING IMMUNOCYTOCHEMISTRY
Tess Kim, Dr. Daniel A. Rappolee, Ph.D.

10:10 - 10:25 ALTERATIONS TO LIMIT HEART DEFECTS IN DEVELOPING MICE EMBRYONIC HEARTS
Heidi Kim, Hyun Jin Son, Dr. Daniel A. Rappolee, Ph.D.

10:35 - 10:50 ESTROGEN REGULATION OF MCP-1 (MONOCYTE CHEMOATTRACTANT PROTEIN-1) LEVELS IN DERMAL WOUND HEALING
Jane Jih, Elizabeth J. Kovacs, Ph.D., Lisa A. Duffner, Julian N. Llanas, Douglas E. Faunce, Parag J. Patel, Meredith S. Gregory

A-113

8:30 - 8:45 AFRICAN PYGMY PEOPLE AND THEIR VILLAGER RELATIONS
Megan Orwig, Dr. Christian Nokkentved

8:55 - 9:10 CLASSIFICATION OF SPECIES WITH *ACER* SERIES *PALMATA* USING MORPHOLOGICAL AND MOLECULAR DATA
Catherine A. Tuglus, Dr. Susan J. Wiegrefe

9:20 - 9:35 DYNAMICS OF THE HANNAFORD WOODS GREAT BLUE HERON ROOKERY
Molly Breslin, Kathy Chen, Mark Ciaccio, Megan Orwig, Dr. David Workman

9:45 - 10:00 COMPREHENSIVE STUDY OF UNDERCOAT OF *CASTOR CANADENSIS* AND ITS HISTORICAL AND ECONOMIC IMPLICATIONS
Erikka Conrad, Nicole Gerlach, Zachary Shipp, John T. Thompson, Dr. Clay Skinner

10:10 - 10:25 ISOLATION OF A TRANSPOSABLE ELEMENT IN THE SMUT FUNGUS USTILAGO VIOLACEA
Amanda Groves, Dan Hamman, Professor Manfred Ruddat

11:00 - 11:15 DETERMINING DISCRETE DIFFERENCES IN MICROSATTELITES AND CHROMOSOME ARM LENGTH RATIOS BETWEEN SPIDER MONKEY (GENUS ATELES) SPECIES AND SUBSPECIES
Lucinda Lawson, Dr. J. Dubach

A-114

8:30 - 8:45	CREATIVITY AND FORMAL EDUCATION Kirti Kamboj, Elissa Larkin, Lynna Quandt, Stephanie Sun, Kimberly Whitlock, Mrs. Andrea Schindler
8:55 - 9:10	EXPLORING MICROSOFT VISUAL BASIC 4.0 Jill Sison, Mike Ososky
9:20 - 9:35	*GÖDEL, ESCHER, BACH*: A STUDY IN FORMAL SYSTEMS AND ARTIFICIAL INTELLIGENCE Eric Mulch, Jill Sison, Maureen Stengler, Mike Ososky
9:45 - 10:00	DEFENSE OF CITIZENS' RIGHTS: THE FIRST AMENDMENT AND FREEDOM OF INFORMATION Sachin Agarwal, Theresa Amato, Myrrha Guzman, Laura Sullivan
10:10 - 10:25	ILLINOIS CAMPAIGN FINANCE REFORM Kevin Costello, Steffany Hreno, Theresa Amato, Myrrha Guzman, Laura Sullivan
10:35 - 10:50	STUDY OF THE IMPACT OF THE TOBACCO EDUCATION GROUP ON TEEN SMOKERS Josh O. Stream, Daniel Wee, Nancy Alcorn-Kell, R.N.

A-115

8:30 - 8:45	AGENT-BASED MODELING AND OBJECTIVE-C PROGRAMMING Alan L. Liu, Jonathan Haas
8:55 - 9:10	THE MISSING LINK: CONNECTING THE HISTORY OF FILIPINO IMMIGRATION TO PRESENT-DAY FILIPINO-AMERICAN CULTURE Anthony Nuval, Bennet Bronson, Peter Stevenson
9:20 - 9:35	PEPSI: A COMPARATIVE OVERVIEW OF THE MARKET Loretta Kelly, Fred L. Fleischbein
9:45 - 10:00	USING WORK MEASUREMENT FOR PRODUCTIVITY IMPROVEMENTS AND LABOR BUDGETING/UTILIZATION OF INCREASED PROFIT WITHIN THE CORPORATION Courtney Meyers, Raymond Yee, Phil Kim, Mike Munoz
10:10 - 10:25	EARNINGS PRE-ANNOUNCEMENTS Drew VanPelt, Ramu Thiagarajan
10:35 - 10:50	VISUALIZATION OF VERIFICATION OF CONCURRENT SYSTEMS Sameer Sundresh, Dr. Patrice Godefroid
11:00 - 11:15	THE QUANTUM YANG-BAXTER EQUATION Travis Schedler, Alexandre Soloviev, Pavel Etingof, Lawrence Votta

A-116

9:45 - 10:00	THE ROLES OF WHITEWARE VS. REDWARE IN NORTHERN ANASAZI SOCIETY Abigail Moy, Dr. Jonathan Haas
10:10 - 10:25	SERIATION AND CHRONOLOGY OF THREE PUEBLO SITES IN THE NORTHERN RIO GRANDE AREA OF NEW MEXICO Aaron Wenzel, Dr. Jonathan Haas
10:35 - 10:50	DEVELOPMENT OF ILLINOIS RAPID ASSESSMENT PROGRAM Sarah Stanfield, John Slapcinsky

A-117

8:30 - 8:45 THE IMPORTANCE AND BENEFITS OF HOSPITAL SCHOOL PROGRAMS
Rahmouna Farez, Aaron Foss, Alice Kim, Juhee Kim, Richard J. Taylor, M.Ed.

8:55 - 9:10 THE NUMBERS OF WIZARD STREET WITH CHILDREN IN CABRINI GREEN
Marcia VanBrunt McMillan, George Colone

9:20 - 9:35 EXAMINING FRIENDSHIP NETWORKS AT IMSA
Amy Meek, Dr. Barbara Schneider, Professor Mihaly Csikszentmihalyi

9:45 - 10:00 THE ROLE OF CORNEAL TOPOGRAPHY IN THE COMBINED PROCEDURE
Veena Villivalam, Timothy T. McMahon, OD, Jamie Putz, Rosisela Ortiz, Laura Kistler

10:10 - 10:25 THE EFFECTIVENESS OF CASA WITHIN THE DUPAGE COUNTY COURT SYSTEM: HOW CAN CHILD ABUSE/NEGLECT BE BEST DEALT WITH?
Irene Czajkowski, Samantha Mulvany, Kathryn Karsh, Ed.D.

10:35 - 10:50 MULTI-CULTURAL PERSPECTIVES ON DEATH AND DYING
Marina Sivilay, David C. Thomasma, Ph.D.

11:00 - 11:15 WHERE DO THEY GO FROM HERE? THE LONGITUDINAL STUDY OF IMSA GRADUATES
Dr. Diann Musial, Jay Thomas

A-119

8:30 - 8:45 PRECLINICAL EVALUATION OF INTERVENTIONAL TECHNOLOGIES, INC. LPSTENTTM
Alice Hsiung, Catie Lichten, Dr. Peter Barath, Ph.D.

8:55 - 9:10 THE CONGENITAL HEART IN ITS MANY FORMS
Anisha Shetty, Dr. Saroja Bharati

9:20 - 9:35 LAB EXPERIENCES IN COMPARATIVE MEDICINE
Lynn Paik, Colin Postlewaite, Lee Cera, D.V.M., Ph.D., Leroy Hirsch, Ph.D.

10:10 - 10:25 EFFECTS OF ESTROGEN ON NITRIC OXIDE SYNTHASE EXPRESSION IN THE ADULT RAT BRAIN
M. E. Kiolbasa, R. J. Handa, Ph.D., R. H. Price Jr.

10:35 - 10:50 THE EFFECTS OF ANDROGEN ON NITRIC OXIDE SYNTHASE EXPRESSION IN ADULT RAT BRAINS
Dan Murariu, Robert J. Handa, Ph.D., Richard H. Price Jr.

A-121

8:30 - 8:45 SEARCH FOR VIOLATION OF CHARGE CONJUGATION INVARIANCE IN ELECTROMAGNETIC PI-ZERO DECAY
Julie Comerford, Yau Wah

8:55 - 9:10 IS PHYSICS THE WAY TO CHEAT IN BASEBALL?
Paul Nikodem, Dr. Richard DeCoster

9:20 - 9:35 NUCLEAR MAGNETIC RESONANCE IN THE STUDY OF SILICA AEROGELS
Peng Wu, Robert E. Botto

A-131

9:45 - 10:00 FERMILAB EXHIBITS ON THE WORLD WIDE WEB
Mason Kidd, Elizabeth Quigg

10:10 - 10:25 BIÈRE! BIER! PIWO! THE BEER INDUSTRIES IN FRANCE, GERMANY, AND POLAND
Kryspin Turczynski, Fred L. Fleischbein

A-147

8:30 - 8:45	EVOLUTION AND STRUCTURE OF HIV-*VPR* GENES AND THEIR POTENTIAL ROLE IN THE CAUSE OF AIDS Kuntal Shah, Emily Wu, Yuqi Zhao, Ph.D.
8:55 - 9:10	FURTHER CLASSIFICATION OF THE NEGATIVE REGULATORY DOMAIN (NRD) OF HEAT SHOCK TRANSCRIPTION FACTOR 1 Kirsten Ishida, Kim Ishida, Dr. Richard I. Morimoto, Sue Fox
9:20 - 9:35	SIMULTANEOUS EXPRESSION OF MULTIPLE GENES Vijay Khiani, Frank Lee, Dr. Paul Scholl
9:45 - 10:00	PRELIMINARY STUDIES TO DETERMINE MOLECULAR MECHANISM OF rmCRP ANTIRETROVIRAL ACTIVITY Vikram Attaluri, Bryan Kim, Mr. William Kabat
10:10 - 10:25	AN EXAMINATION OF EPOXIES CONCERNED WITH WHITE COIL DISEASE Kenneth Tong, Barbara Sizemore, Jay Hoffman
10:35 - 10:50	EFFECTS OF *IN VITRO* AMYLOID ß (Aß) (25-35) ON HUMAN CORTEX PROTEIN PHOSPHATASE 2B (CALCINEURIN) ENZYME ACTIVITY Steven Baker, Dr. John Lee
11:00 - 11:15	IS THERE TOLERANCE OR SENSITIZATION TO ACUTE DOSES OF AMPHETAMINE? Dana Johnson, Angela Justice, Dr. Harriet DeWit

A-148

8:30 - 8:45	URINARY MODIFIED NUCELOSIDE LEVELS IN BRAIN TUMOR PATIENTS Nick Puangsuvan, Dr. Joseph R. Moskal, Suzanne L. Greene
8:55 - 9:10	PTEN GENE AS A TUMOR SUPPRESSOR THROUGH ALTERATION OF TUMOR FOCAL ADHESION Brian Kim, Dr. Joseph R. Moskal, Dr. Hirotaka Yamamoto, Daniel M. Marginean, Suzanne L. Greene
9:20 - 9:35	THE ASSOCIATION OF PROTEIN PHOSPHATASE-2A WITH TUBULIN AND ACTIN COMPONENTS OF THE CYTOSKELETON IN LEWIS LUNG CARCINOMA CELLS Irene Ma, Dr. M. Rita Young, Jeremy Meisinger
9:45 - 10:00	THE EFFECTS OF AGE, GROWTH FACTORS, PROSTAGLANDIN, AND PROSTAGLANDIN SUPPRESSORS ON CYTOKINE PRODUCTION Charley Ding, Dr. Rita Young, Dr. Margaret Prechel
10:10 - 10:25	EFFECTS OF VARIED ELECTROMAGNETIC FIELDS AT 60 Hz IN THE REGULATION OF THE MULTIDRUG RESISTENCE GENE IN T-LYMPHOCYTIC HUMAN LEUKEMIA CELLS Jason Andrews, Shilpa Iyer, Robert J. Walter, Ph.D.
10:35 - 10:50	EFFECT OF SOYBEAN ISOFLAVONE CONCENTRATE ON HUMAN IMMUNE CELLS Riley Aumiller, Jimmy S. Cheung, Rajabatehr Krishnaraj, Mohipal Singh Poria

A-149

8:30 - 8:45	DETERMINING PROTEIN-LIGAND BINDING AFFINITIES USING PULSED ULTRAFILTRATION Adam Rojan, Dr. Richard van Breemen
8:55 - 9:10	THE CORRELATION OF CRI, QI, AND BEAM Adrian Wong, Kenneth Nelson. D.O.
9:20 - 9:35	TOWARD THE SYNTHESIS OF TETRACYCLIC QUINOLONES: THE SYNTHESES OF AMINO ACID DERIVED PIPERAZINES Christen Klochan, Dr. Robin M. Zavod
9:45 - 10:00	SELECTION FOR CALCIUM RESISTANT DROSOPHILA Patri Marie Marconi, Dr. Ronald Dubreuil
10:10 - 10:25	AN INVESTIGATION INTO THE TRANSIENT ELECTRIC FIELDS ARISING IN RESPONSE TO A POTENTIAL DIFFERENCE BETWEEN METALLIC BIOLOGICAL MATERIALS AND THE IN VIVO ENVIRONMENT Adnan Husain, Dr. Jeremy Gilbert
10:35 - 10:50	PURIFICATION OF VIRACEA, A NEW DRUG USED TO BATTLE THE HERPES SIMPLEX-1 VIRUS Margaret O'Leary, Dr. Ken D. Thompson
11:00 - 11:15	ATP-INDUCED MORPHOLOGICAL CHANGES IN H. PSEUDOLIGACTIS Derrick Tung, Vicki Musial

A-150

8:30 - 8:45	PERFORMANCE EVALUATION OF A COMPREHENSIVE COAGULATION ANALYZER (MCA 310) STUDIES ON NORMAL AND SIMULATED ANTICOAGULATED WHOLE BLOOD AND PLASMA Ramona Bhatia, Candi Reincke, Dr. Jawed Fareed, Dr. Omar Iqbal
8:55 - 9:10	PEMPHIGUS VULGARIS - IDENTIFYING THE ANTIBODY BINDING SITES Vishnu Kurella, B.S. Prabhakar, G. S. Seetharamaiah
9:45 - 10:00	MECHANICAL ANALYSIS AND THEORETICAL COMPARISON OF CAPACITANCE GAUGES Anna Szary, Tricia Heger, Joe Ozelis
10:10 - 10:25	RESEARCHING THE HIGGS BOSON WITH MONTE CARLO PROGRAMS Ronald Roth, Dr. G. P. Yeh
10:35 - 10:50	THE ACCELERATOR-BASED ARGONNE INFORMATION CENTER (AIC) EXHIBIT Maurice Cheung, Y.C. Chae, Ph.D., S.G. Biedron, L. Teng, Ph.D.

A-151

8:30 - 8:45	IDENTIFICATION AND CLASSIFICATION OF OBJECTS IN COMPUTER VISION Justin Ramos, Doug Strain, Joshua Flachsbart
8:55 - 9:10	THE APPLICATION OF NEURAL NETWORKS TO EMULATE INTERNATIONAL TRADE Anand Dash, Mark Hoemmen, Doug Strain, A.K. Hobbs, Ph.D.
9:20 - 9:35	TOOLS AND SCRIPTS FOR AN ONLINE COURSE Joanna Francis, Laura Mengel
9:45 - 10:00	DETERMINATION OF FIBROBLAST GROWTH FACTOR RECEPTOR (FGFR) EXPRESSION IN RAT'S HEART CELL LINE BWEM Madhav Upadhyaya, Jennifer Yam, Dr. Gary Engelmann, Ph.D., Melody Gane, M.S.
10:10 - 10:25	DEVELOPMENT OF AN ELISA ASSAY SYSTEM FOR THE DETECTION OF MOUSE ANTI-HUMAN CD30L ANTIBODIES Michael Y. Liu, T. Ellis
10:35 - 10:50	COMPLEMENT INHIBITORS - USE IN XENOTRANSPLANTATION Kathy Chen, Stephanie Wu, Dr. Byron Anderson
11:00 - 11:15	RECURRENCE QUANTIFICATION ANALYSIS OF EXONS AND INTRONS S. Maripuri, C. L. Webber Jr.

8:30 - 8:45	FLUID DYNAMICS AND SOLIDIFICATION OF MOLTEN SOLDER DROPLETS IMPACTING ON A SUBSTRATE Michael Blitstein, Dr. C. M. Megaridis
8:55 - 9:10	THE EFFECTS OF OXIDATION ON CERAMIC COMPOSITES P. J. Balin, M. J. McNallan
9:20 - 9:35	CONTROLLING A MICROELECTROMECHANICAL CLAMP USING THE BASIC STAMP II MICROCONTROLLER Ethan Wozniak, Dr. Selcuk Guceri, Dr. Bradley Nelson
9:45 - 10:00	CALIBRATION OF AN ACOUSTIC ANECHOIC CHAMBER Linus Wong, Thomas J. Royston, Ph.D., Curt Priessner
10:10 - 10:25	PART DESIGN AND MANUFACTURING USING PRO/ENGINEER AND RAPID PROTOTYPER Greg Bethel, Dr. Selcuk Güceri
10:35 - 10:50	CONSTRUCTION OF SiC MICROPIPETTES: FEASABILITY TESTING Terry Koo, Yury Gogotsi, Ph.D., Michael Gardner
11:00 - 11:15	MULTITASKING SYSTEMS ON THE i386 Sameer Sundresh, Susan Yates

(abstracts can be found in alphabetical order under the first presenter)

OVARIAN AUTOIMMUNITY AND POLYCYSTIC OVARY SYNDROME (PCOS)

Peter Adamczyk, Illinois Mathematics and Science Academy Aurora, Illinois 60506; 630-907-5720; magic@imsa.edu

Mentors

Dr. Judith Luborsky, Associate Professor and Director of Endocrine Immunology, Department of Obstetrics and Gynecology, Rush University Medical College, Chicago, Illinois 60612; 312-942-6602; jluborsk@rush.edu

Brainard Llanes, Research Technician, Department of Obstetrics and Gynecology, Rush University Medical College, Chicago, Illinois 60612; 312-942-6602; bllanes@rush.edu

Ovarian autoimmunity is frequently associated with premature menopause and infertility. It has also recently been suggested that a subgroup of Polycystic Ovary Syndrome, (PCOS) possesses an autoimmune etiology. The objective of this research was to test the hypothesis that PCOS is associated with ovarian antibodies and elevated regulatory cytokines (IL-4, INF-γ). Ovarian antibodies were measured by an established ELISA immunoassay and cytokines were measured with a commercial immunoassay. Frequency levels for ovarian antibodies were found to be significantly different ($p<.0005$) in PCOS (28%) than in infertility (61%) and premature menopause (53%) but were similar to control and population (17%) values. Measurable cytokines were found in all categories but were more frequently elevated in PCO patients (62%) than in infertility patients (24%) or normal controls (35%-50%). These results indicate that PCO does not appear to be significantly associated with ovarian autoimmunity as determined by this immunoassay. Since cytokines, as markers of immune dysregulation were elevated, there is evidence for immune dysregulation in PCOS. The nature of this immune dysregulation remains to be determined. We plan to further assess the potential autoimmune basis of PCO through an evaluation of lutenizing hormone (LH) receptor autoantibodies.

A COMPARATIVE STUDY OF CYTOKINES INVOLVED IN B- LYMPHOPOIESIS IN AGED AND YOUNG MICE

Abidemi Adeboje, Illinois Mathematics and Science Academy, Aurora, Illinois 60506; 630-907-5746; abidemi@imsa.edu

Mentor

Dr. Pamela Witte, Department of Cell Biology Neurobiology and Anatomy, Stritch School of Medicine, Loyola University Chicago, Maywood, Illinois 60153; 708-216-3358

B-lymphopoiesis is regulated by a number of cytokines/growth factors produced in the bone marrow. The primary growth factor is IL-7, which is enhanced by a number of additional cytokines, such as IGF-1 and stem cell factor. B-lymphopoiesis has been shown to decline with age, marked by a significant decrease in the pre-B cell population. This laboratory has previously shown that the production/secretion of IL-7 decreases with age, although changes in other growth factors have not yet been examined. In contrast to the decline in pre-B cells, the most differentiated of B-cells, the plasma cell, increases in frequency in the bone marrow. This has led to our hypothesis that some aspect of the marrow microenvironment changes during aging to promote skewing in the balance of pre-B and plasma cells. The key may be age-related differences in the production of growth factors by the marrow microenvironment. We have used the polymerase chain reaction (PCR) to screen for changes in growth factors. Specifically we have looked at cytokines which augment IL-7, namely IGF-1 and stem cell factor, as well as cytokines which stimulate plasma cells, such as IL-6. Comparisons were made between old mice and their young counterparts.

DEFENSE OF CITIZENS' RIGHTS: THE FIRST AMENDMENT AND FREEDOM OF INFORMATION

Sachin Agarwal, Illinois Mathematics and Science Academy, Aurora, Illinois 60506; 630-907-5507; sachinag@imsa.edu

Mentors

Theresa Amato, executive director (Esq.), Citizen Advocacy Center, PO Box 420, Elmhurst, Illinois 60126; 630-833-4080; amato@essential.org

Myrrha Guzman, community lawyer (Esq.), Citizen Advocacy Center, PO Box 420, Elmhurst, Illinois 60126; 630-833-4080

Laura Sullivan, community lawyer (Esq.), Citizen Advocacy Center, PO Box 420, Elmhurst, Illinois 60126; 630-833-4080

This research focused on limits placed on citizen rights to free speech, namely, restrictions on speech at public meetings and limits placed on students. Case law was studied and analyzed to draft comments on proposed policy at Elmhurst School District 205 meetings, policy at Elmhurst City Council meetings, and censorship at the Naperville North High School North Star student newspaper. Comments were drafted on proposed legislation regarding the Illinois Freedom of Information Act. In addition, numerous letters were sent to various publications, notifying the citizenry of First Amendment violations made or contemplated by their elected officials. Research was also done on limits placed on students' First Amendment rights within the "schoolhouse gates," including limits on spoken and unspoken speech.

OSTEOGENIC PROTEIN-1 AND INTERLEUKIN-1 ON ADULT BOVINE CHONDROCYTES CULTURED IN ALGINATE

Angel Alvarez, Illinois Mathematics and Science Academy, Aurora, Illinois 60506; alvarez@imsa.edu

Mentor

Dr. Koichi Masuda, Rush Medical College, Rush-Presbyterian St. Luke's Medical Center; Department of Biochemistry and Orthopedic Surgery, Department of Internal Medicine-Section of Rheumatology; 1653 West Congress Parkway, Chicago, Illinois 60612

Arthritis, the most common medical ailment next to sinusitis (sinus infection), has an annual expense of over 54 billion dollars. The condition results from the degradation of the cartilage cellsÆ (chondrocytes) extracellular matrix, which cause the cartilage to degenerate. If there existed a means to regenerate this cartilage by stimulating chondrocytes to up-regulate their synthesis of extracellular matrix and specific macromolecules then a possibility of counteracting the arthritic process could follow. Osteogenic protein-1 brings that possibility closer to reality since it is the only known factor shown to increase extracellular matrix synthesis in mature chondrocytes. In the present study we examined the effects of Interleukin-1, which mediates matrix degradation, and OP-1 on alginate cultured bovine chondrocytes.

OP-1 was able to dramatically regenerate the cell matrix and increase macromolecular production as well as proliferate to a 40% greater cell number than the control [compared to the 33% decrease in the IL-1 culture]. Thus, OP-1 was able to reproduce a larger matrix of bovine chondrocytes, similar to that of native cartilage, in cell culture.

EFFECTS OF VARIED ELECTROMAGNETIC FIELDS AT 60 Hz IN THE REGULATION OF THE MULTIDRUG RESISTENCE GENE IN T-LYMPHOCYTIC HUMAN LEUKEMIA CELLS

Jason Andrews, Illinois Mathematics and Science Academy, Aurora, Illinois 60506; jason@imsa.edu
Shilpa Iyer, Illinois Mathematics and Science Academy, Aurora, Illinois 60506; shilpe@imsa.edu

Mentor
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Previous studies have shown the following effects of electromagnetic fields (EMFs) upon humans: accelerated tumor growth, changes in functions of cells and tissues, alterations of the immune system, changes in brain activity and heart rate, and changes in biorhythms. Our concern lies within occupational exposure to EMFs. Previous studies on the effects of 60Hz EMFs (330 or 750 mV/cm for 60 min.) on human leukemia cells have found decreased protein kinase C activity and activation of the multidrug resistance gene which codes for the P-glycoprotein pump (P-gp). In our study we began by varying voltage (3mV/cm- 3000mV/cm) of the EMF applied to K562 (T-lymphocyte) wild type and multidrug resistant cell types for a constant exposure time of 45min. We loaded the cells with rhodamine (a phosphorescent marker prior to exposure of the cells and then quantified efflux of rhodamine by flocytometer analysis. Our data showed an increase in rhodamine efflux at or greater than 1 mV/cm, and this phenomenon was more prominent at increased voltages. At this time we are unsure of how EMF exposure directly effects the increased activity of the P-gp but plan to examine grouping of P-gp on the membranes, possible ion imbalances, and effects of EMFs on cells under P-gp inhibitors.

THE STARVED ROCK PROJECT: UNE CANNOT DU BOIS

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In 1684 the Iroquois lay siege to Fort St. Louis des Illinois at Starved Rock. During the battle of Starved Rock fourteen French merchants, ignorant of the battle, traveled to Starved Rock to bring provisions and support to the fledgling fort. When they were looted and kidnapped by two hundred Iroquois en route to the battle, Le Bebre de La Barre, Governor of New France, felt revenge was necessary and by seeking revenge caused a series of battles which eventually developed into the French and Indian Wars, a series of wars that ended the French presence in Illinois, and the New World. We will examine the raid on the merchants. The centerpiece of our presentation will be a replica of the dugout canoes used by the French in Illinois during the latter half of the 17th century. This canoe, crafted entirely at the Illinois Mathematics and Science Academy, will be part of a Visitor's Center at Starved Rock.

PRELIMINARY STUDIES TO DETERMINE MOLECULAR MECHANISM OF rmCRP ANTIRETROVIRAL ACTIVITY

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C-Reactive Protein (CRP) has long been recognized as a reactant of the acute phase of innate immunity. Previous studies in our lab and others have shown that a recombinant form of the protein termed r-modified C-reactive Protein (rmCRP) has inhibitory effects against SIV and lab strains of HIV, both RNA-class viruses. In a segment of our study, we sought to determine if rmCRP is also effective against Cytomegalovirus (CMV), a DNA-class virus. However, our results indicated no antiviral activity of rmCRP against CMV.

In the remainder of our study, we concentrated our efforts towards examining the mechanism of activity of rmCRP. Although the characterization of rmCRP's antiretroviral activity has been completed, the biological activity of the protein is still unknown, despite many hypotheses. One of these hypotheses, interactions of rmCRP within the cytoskeleton, was chosen for further study. Our goal for this part of the study was to establish a method to examine the proteins of the cytoskeleton and rmCRP in infected and uninfected cells to be used in the future to examine the role and activity of rmCRP in the cell. Through a series of trials, a promising procedure to stain proteins within cells with fluorescent dyes for examination was developed.

EFFECT OF SOYBEAN ISOFLAVONE CONCENTRATE ON HUMAN IMMUNE CELLS

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Soybean extract is known to have several biological effects in humans and animals, both in vivo and in vitro. In order to understand the immune-boosting potential and the anticarcinogenic effects of soybean, we tested Soybean Isoflavone Concentrate (SIC). SIC contains various types of isoflavones, including genistein and diazdin, which may influence the growth of cancerous cells. In addition, some of the anti-cancer properties isoflavones may be due to their ability to boost the immune system, which can normally destroy the cancerous cells. We tested the acute effect of the SIC solution in vitro on two human cell lines: natural killer (NK) cells and K562, a NK-sensitive human leukemia cell line. Since interferon gamma (IFN-γ) boosts immune system and plays an anti-cancer, the cytoplasmic accumulation of IFN-γ was tested my immunoflourescence staining of NK cells followed my flow cytometric analysis. Incubation of NK cells with SIC resulted in a significant activation of these cells to produce the proinflammatory cytpokine .viz., IFN-γ . Further tests to evaluate if SIC has an effect on the leukemia tumor target cells has shown a similar action but of lower magnitude. We conclude that the dual ability of phytochemicals in SIC could play a dual role in eliciting health protective actions. Thus, other clinical useful biological actions of soybean, a functional food, are being investigated at molecular and immunological levels.

EFFECTS OF *IN VITRO* AMYLOID ß (Aß) (25-35) ON HUMAN CORTEX PROTEIN PHOSPHATASE 2B (CALCINEURIN) ENZYME ACTIVITY

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In America today, Alzheimer's disease (AD) is present in five to fifteen percent of people over the age of 65. The major histopathological hallmarks of AD are the development of senile plaques composed of Aβ[1-40] and later the appearance of neurofibrillary tangles composed of hyperphosphorylated tau protein. Previously, Ladner et. al. (J. Neuropath. and Exp. Neurol. 55:924, 1996) showed a decrease in the activity of protein phosphatase 2B (calcineurin) in AD which may lead to hyperphosphorylated tau. Since Aß is also present in the assay from AD samples, we determined if Aß could directly inhibit calcineurin *in vitro*. Spectrophotometric assays were run using para-nitrophenylphosphate as a substrate to detect a change in calcineurin phosphatase activity in the presence of Aß[25-35], which forms ß-pleated sheets similar to Aß[1-40]. In P2 membrane fractions from four control non-AD cases, we found that preincubation with 10 μM Aß[25-35] did not directly inhibit basal, nickel (1mM), or manganese (1mM) stimulated phosphatase activity. Therefore, the decrease in calcineurin activity seen in AD does not appear to be due to direct inhibition of the enzyme by Aß. In the future, we would like to repeat the assay with Aß[1-40] and Aß[1-42], which are the predominant Aß isoforms present in AD brains.

THE EFFECTS OF OXIDATION ON CERAMIC COMPOSITES

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Ceramic composites commonly used in aerospace applications were fabricated using Nextel 312^{TM} ceramic fiber and Blackglas^{TM} preceramic polymer, resulting in a composite based on silicon oxycarbide glass. This involved resin transfer molding followed by both cure and pyrolysis heating cycles. Samples were cut from the prepared panels and subjected to oxidation in both dry and humid environments for varying amounts of time at 600^{o}C. Testing in the form of three and four point flexure tests were performed to characterize the effects sample size, pyrolysis temperature, time of exposure, and humidity on the mechanical properties of the samples. The results of these oxidation tests as well as sample preparation procedure will be discussed.

STARVED ROCK PROJECT

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Starved Rock State Park in central Illinois was once home to the first European settlers of Illinois, at the site La Salle, early explorer of the Mississippi River Valley, built a fort to serve as a base of operations in his bid to control the region. The fort was named Fort St. Louis des Illinois and had a rich history as a French trading post.

The history of the site has received little analysis and too little is known of its importance. A thorough research has been done into the documented data on the site; and a model of the fort at the time of an Iroquois attack in the late 1680s was constructed. These things will be combined with a dugout canoe like those used by the French to form a museum exhibit for the Starved Rock State Park Visitor's Center. The purpose of this work is to better inform park visitors about the importance of the site.

PART DESIGN AND MANUFACTURING USING PRO/ENGINEER AND RAPID PROTOTYPER

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Mentor

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Pro/Engineer is a 3-D design computer program. It is extremely powerful due to its parametric setup, meaning that any dimension or feature can be altered at any point in the process. This grants much more freedom to the designer than other programs, such as Auto-CAD, where this is not possible. Parts modeled in Pro/Engineer can be converted to files that can be read by a Stratasys rapid prototyping machine. This very precise machine can "print" the part in 3-D form by extruding melted plastic through a nozzle that can move in the x and y planes while a platform moves in the z plane. The nozzle, only $12/1000^{th}$ of an inch in diameter, extrudes the "roads" of plastic in a controlled pattern in $1/100^{th}$ of an inch thick layers. Pro/Engineer was then used to design a tape guide that is necessary in the making of thermoplastic rings manufactured using a laser-assisted on-line consolidation process. This tape guide ensures the position of the incoming tape as it is melted by the laser, thus forming smooth rings. This process is used in the manufacturing of parts in the aerospace and automotive industries.

PERFORMANCE EVALUATION OF A COMPREHENSIVE COAGULATION ANALYZER (MCA 310) STUDIES ON NORMAL AND SIMULATED ANTICOAGULATED WHOLE BLOOD AND PLASMA

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Several automated instruments have recently become available for the testing of coagulation parameters. This is important not only in the diagnosis of bleeding and clotting diseases, but also in the monitoring of anticoagulant drugs. Frequently the results of clotting tests are needed urgently and require a short amount of time in such situations as heart attack, stroke, and acute bleeding streaks. Routinely, whole blood collected for testing is centrifuged to obtain plasma. This step requires a centrifuge and appropriate laboratory wear for separation and collection of plasma. This adds up to approximately forty-five minutes in turn around time. By utilizing a microfiltration technique the MCA 310 is capable of producing in less than twenty seconds, directly from the collection tube without centrifugation. In a comparative study the MCA 310 was evaluated with the fibrometer using normal human donor whole blood (citrated) and plasma samples. Global clotting tests were carried on MCA 310 and the fibrometer. Since a microfiltration technique is used, and the centrifugation step is omitted, this instrument offers a total coagulation analyzer with much shorter turn around time. This instrument, therefore, will be used in ambulatory settings where a rapid turn around is essential.

FLUID DYNAMICS AND SOLIDIFICATION OF MOLTEN SOLDER DROPLETS IMPACTING ON A SUBSTRATE

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This research investigates fluid dynamics and simultaneous solidification of molten solder droplets impacting onto a flat substrate. The impact of molten metal droplets onto a surface is studied in a controlled nitrogen environment. The piston of the solder droplet generator releases a droplet of 1 millimeter diameter on demand onto a substrate. The shape and motion of the droplet during flight and impact is watched and recorded on high speed video. The technology being studied is used to simulate microscopic solder droplets for surface mounting of microelectronic devices. Understanding the fluid and heat dynamics of the solder droplet impact will increase the efficiency and cost effectiveness of microelectronic surface mounting.

INVESTIGATION OF LOW-MOLECULAR WEIGHT HEPARINS AS POTENTIAL SUBSTITUTE DRUGS FOR HEPARIN IN HEPARIN-INDUCED THROMBOCYTOPENIA

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Heparin-induced thrombocytopenia(HIT) is an allergic platelet activation response caused by heparin. Patients can have severe thrombotic complications, amputation and mortality. The focus of this study was to determine whether or not low-molecular weight heparins(LMWH) are suitable substitutes for heparin in HIT. Two different assay systems were used(Platelet Aggregation Profiler and the Flow Cytometer) and 4 LMWH were evaluated[Fraxiparin(Fraxi), SR80486A(SR), Pentasaccharide(Penta), and ORG10172(ORG)]. For 16 HIT positive sera 50% with Fraxi had a positive response at 5μg/ml; 60% at 10μg/ml; 0% at 50μg/ml; 18.75% of samples were positive with SR at 5μg/ml; 0% at both 10 and 50μg/ml. All Penta concentrations showed 0% positive response. ORG showed a 25% positive response at 5μg/ml and 18.75 at both 50 and 500μg/ml. The heparin control showed 100% response at 5μg/ml. ORG(5μg/ml) showed an average aggregation of 18.75%; 16.00% at 50μg/ml; 18.00% at 500μg/ml. SR(5μg/ml) showed 8.125% average aggregation compared to 55% for heparin. These results show that ORG and Fraxi performed less than that of heparin; however, aggregation still occurred. Penta and SR might be suitable replacements for heparin in HIT. The frequency of positive responses and aggregation for these two drugs was lower than heparin. Results from the Flow Cytometry will aid in how these drugs work in platelet responses.

DYNAMICS OF THE HANNAFORD WOODS GREAT BLUE HERON ROOKERY

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We have been studying the Hannaford Woods great blue heron rookery since the 1994-95 school year. Our studies have concentrated on the impact that a new housing development directly to the east of the rookery has had on nesting patterns, and last year we extended our focus to include the relevance of nest size and age to chick survival. For the first two years of our study, we found that the center of gravity of the rookery was moving away from the housing development; neither the number of nests nor the number of surviving chicks changed significantly. During the 1996-97 school year, our heron and nest counts declined drastically. The rookery was also damaged by severe wind storms, and we could not ascertain that any chicks grew to maturity. We are currently watching the remaining nests in the rookery to discover whether any herons will return or whether they will build a new rookery in the area.

COMPLEMENT INHIBITORS - USE IN XENOTRANSPLANTATION

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Xenotransplantation is the relatively new science of transferring organs across species. Porcine organs have been considered as the choice xenograft because of the similarity in organ sizes, physiology between the pig and human and the availability of pig organs. Alpha-Gal epitopes found in every species except for humans and Old World monkeys exist on the porcine endothelial cells. When the anti-alpha -Gal antibodies of the IgG and IgM classes, naturally found in human blood, react and bind to the epitopes on the endothelial cell of the graft, complement activation is initiated resulting in cell lysis and activation of the clotting system with resultant trombosis and ischemia of the organ. This series of reaction is termed Hyper-acute rejection (HAR).

In this study, we tested the efficiency of different human complement inhibitors in hopes of finding an optimal solution that would enable successful xenotransplants. C1q binding to immunoglobulins initiates complement activation. Several peptides that can inhibit this binding exist and therefore present a possibility of preventing HAR. In the laboratory, we tested several peptides using a red-blood cell lysis and complement activation assay. The diaromatic peptide, tryptophan - tyrosine (WY) as a dextran conjugate was shown to be an effective inhibitor of human complement activation. In additional studies, the same peptide and conjugates have shown activity in prolonging xenograft survival, using a guinea pig heart transplanted to the rat animal model.

THE ACCELERATOR-BASED ARGONNE INFORMATION CENTER (AIC) EXHIBIT

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The AIC Exhibit was designed to make accelerator physics understandable for non-physicists such as high-school students. It consists of illustrated story boards that outline the history of Argonne and other accelerators around the world as well as story boards that explain the actual physical exhibit. Three tables were prepared for the

exhibit. One contains components of two different linear accelerators (dipoles and quadrupoles) as well as an electron gun. The second contains an actual, miniature linear accelerator that consists of an electron gun, a focusing triplet (consisting of three quadrupoles) and a focusing dipole. This is the Electron Linear Accelerator Exhibit (ELLE). The third table contains the optics counterpart of ELLE, the Light Educational Exhibit (LEE). LEE consists of a laser, three focusing lenses, and a prism. The respective parts of ELLE and LEE have corresponding roles. The triplet in ELLE and the three lenses in LEE serve to focus the electron and laser beam. The dipole in ELLE and the prism in LEE serve to bend the beam to a desired position.

EXHIBITION OF ORIGINAL STUDENT MUSICAL COMPOSITION

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IMSA students often demonstrate creative abilities far beyond mathematics and sciences. Musical Composition has been a lesser known, but highly prolific area of talent for several students. To be performed is an original musical composition by Mark Ciaccio entitled, "Dream Sketches: Concerto for Violin and Piano". This work in three movements forms a synthesis between romantic and contemporary musical styles to create a unique blend of old and new. It is to be performed by Chicago Youth Symphony Orchestra Member, Sarah Moss, and IMEA State Composition winner, Mark Ciaccio.

SEARCH FOR VIOLATION OF CHARGE CONJUGATION INVARIANCE IN ELECTROMAGNETIC PI-ZERO DECAY

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Historically, much progress has been made in elementary particle physics after symmetry breaking discoveries, such as parity violation and CP violation in weak interaction. Theoretically, charge conjugation invariance is conserved in electromagnetic interaction, and presently there is no experimental evidence of violation. The KTeV (Kaons at TeVatron) experiment at Fermi National Accelerator Laboratory finished collecting data with a state-of-the-art detector in September of 1997. This data allows the search for the decay mode pi-zero to three gamma rays, which violates charge conjugation symmetry if observed. The pi-zero comes from the copious K-long to three pi-zero decay. The search looks for the signature of the first pi-zero decaying to two gamma rays, the second pi-zero decaying to an electron, a positron, and a gamma ray, and the third pi-zero decaying to three gamma rays. Analysis algorithms based on relativistic kinematics and geometric constraints are being developed to reconstruct these events.

COMPREHENSIVE STUDY OF UNDERCOAT OF *CASTOR CANADENSIS* AND ITS HISTORICAL AND ECONOMIC IMPLICATIONS

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Beaver undercoats have long been an important economic commodity. The fur of the beaver is regarded as making the highest quality hat felt. Their use in the European hat industry sparked the influx of many fur trappers and traders into the northern United States and Canada between 1580 and 1840, when beavers were driven nearly to extinction. There is limited research in which the undercoat has been looked at in a scientific manner to determine what qualities make it so valuable as felt. Using bright field and electron microscopy, the beaver hairs were compared to several other types of hairs, such as rabbit and sheep, to determine what properties give it its unique felting ability. The results were then placed into an economic and historical context, to further the understanding of human-beaver interactions.

ILLINOIS CAMPAIGN FINANCE REFORM

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Using research on campaign finance reform, a survey was constructed and administered to citizens in the 630 area code. The survey was administered by telephone, and citizens were picked randomly using a phone book. The survey gauged citizen response to various proposed reforms to the Illinois campaign finance system. While the survey is still in progress, preliminary results will be discussed. Federal and other state regulations will be discussed in conjunction with Illinois's system, proposed state reforms, and public opinion reflected in the survey.

EVIL AND THE INVERSION OF NATURAL ORDER IN SHAKESPEARE'S MACBETH

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Three tragic themes run strongly throughout Macbeth: natural vs. unnatural, reality vs. insubstantial, light vs. darkness. The essence of tragedy in this play lies in the consequences of going against the natural order set up by the dialectics defined above. Evil, as explored in the play, is the inversion of this natural order. Two characters central to the development of these themes are Banquo and Lady Macbeth. Their significance lies not only in the passages spoken by each; but in how these passages define their characters, making them symbols Shakespeare uses to frame Macbeth's fall in a society where Christian values dominate what is good, and natural, and real.

THE EFFECTIVENESS OF CASA WITHIN THE DUPAGE COUNTY COURT SYSTEM: HOW CAN CHILD ABUSE/NEGLECT BE BEST DEALT WITH?

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Court Appointed Special Advocates (CASA) is a not-for-profit organization that serves children who have been abused or neglected. A group of trained people, called advocates, volunteer their time to get to know an abused/neglected child and monitor their case in juvenile court. They write and submit reports to the court that state objective observations, without giving recommendations, which are used to help the judge decide what is in the child's best interest. For our research, we examined the effectiveness of CASA. A survey was sent to the advocates, people within the court system that have worked with a CASA, and parents of the children that CASA serves. On the average, most people were happy with the way the program was working. The information gathered from these surveys helped to bring about some changes in the way CASA functions. The specific results and changes made will be discussed, as will our findings from a comparative analysis between CASA cases and other abuse/neglect cases in the court system not assigned to a CASA. In addition, we will discuss our experiences in meeting with court personnel, sitting in on court cases, and working with CASA.

THE APPLICATION OF NEURAL NETWORKS TO EMULATE INTERNATIONAL TRADE

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A neural network model of global economic policy was created and developed. The complex dynamics of each nation are simplified to a single trading entity with certain attributes which change with time. Each neural network is allowed to control a "nation". Each nation works to trade in such a way as to obtain the most commodities. Several learning algorithms were examined in designing the model. A version of Hebb's law was chosen for its property of forming correspondences between sets of similar external inputs and the responses best suited for those inputs. The neural networks and the economic model were implemented as C++ classes, permitting simple expansion, reusablity, and modification of the code for future users' specifications.

THE EFFECTS OF AGE, GROWTH FACTORS, PROSTAGLANDIN, AND PROSTAGLANDIN SUPPRESSORS ON CYTOKINE PRODUCTION

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In this project, we attempted to analyze the levels of specific factors produced by glial cells in the brains of mice. It is known from research conducted last year that microglial cells can become activated with age and with the treatment of indomethacin, a prostaglandin suppressing chemical. Activated microglia can produce a variety of factors which can be toxic when present in excess amounts in the CNS. Using ELISA protocols, we examined the levels of the following factors produced by glial cells in the brains of young and old mice : IL-6, TNF-α, GM-CSF, and IL-1β. Experiments suggest that tissue treated with growth factors such as LPS and GM-CSF exhibited less quantities of TNF-α than untreated tissue. In addition, tissue treated with LPS produced less GM-CSF than untreated tissue. No correlation has been determined to date about the levels of cytokines produced between young and old mice. In humans, an excess amount of any of these factors can produce serious health conditions; this project contributes to our knowledge of their presence in the CNS.

THE IMPORTANCE AND BENEFITS OF HOSPITAL SCHOOL PROGRAMS

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Continuing the education of pediatric hospital patients plays an integral role in the holistic approach to the child's recovery and growth. Hospital school programs provide the ideal environment for school-age patients, addressing comprehensive medicine that includes pyschological, social, and academic needs of a child. Our research came from data gathered at the Hospital School Program of the Ronald McDonald Children's Hospital of Loyola University Medical Center. The program is offered to all hospitalized school-age patients and varies for each individual. Educational service ranges from, bedside tutoring to group instruction with the aid of books, computer programs, videos and educational enrichment activities. The Hospital School Program coordinator also acts as a liaison between the child and the school district, helping to aleviate academic concerns of the patient and the family. This study presents the benfits and importance of hospital school programs within the scope of a

specific facility, however, increased nation-wide knowledge and awareness of such educational programs are necessary for the improvement and development of pediatric hospital care.

TOOLS AND SCRIPTS FOR AN ONLINE COURSE

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Throughout the year various projects were completed on the Fermilab Education web server (http://www-ed.fnal.gov). Most of the work done was for the LInC Online project, which is an online course to help teachers use technology and the Internet to support "engaged" or "problem-based" learning. The projects fell into two main categories. First, there were many technical tasks including HTML coding, writing forms used in surveys and feedback, and writing small perl programs to convert text files to online forms. The second group of projects were more open-ended, and included such things as searching the web for and evaluating new software that might be useful to either the web server or participants in LInC's online course. In addition, the year's work included an essay about experiences with problem based learning from a student's perspective, which was used to give teachers a different perspective on some of the relevant teaching methods.

ISOLATION OF A TRANSPOSABLE ELEMENT IN THE SMUT FUNGUS USTILAGO VIOLACEA

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Certain strains of the smut fungus U. violacea exhibit an unusually high rate of mutation expressed in the carotene pigmentation phenotypes.[Garber, E.D. and Ruddat, M. Theoretical Applied Genetics. 89:838-846. (1994)]. The only plausible explanation is that a meiotic, transcentric transposable element (TE) exists. We began to search for molecular evidence of the TE, concentrating on the carotenoid genes that encode the pigments coloring the sporidial colonies. To find the TE, we isolated the DNAs from stable strains(which we assume do not contain the TE) and unstable strains(which we assume do contain the TE) of the fungus with the intent of cutting them with restriction enzymes and electrophoresing the digest. The carotenoid gene of the stable strain traveled farther than the carotenoid gene of the unstable strain because the TE made the gene larger. In a Southern Blot we hybridized the carotenoid gene of the two strains with an E. coli plasmid, which contains the carotenoid gene, in order to clone the TE-containing carotenoid gene. The nature of transposable elements will be discussed as well as the protocols which we used and the complications that arose from them.

PRECLINICAL EVALUATION OF INTERVENTIONAL TECHNOLOGIES, INC. LPSTENTTM

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Percutaneous Transluminal Coronary Angioplasty (PTCA) is a minimally invasive procedure used to treat coronary artery disease. During this procedure, a balloon is inflated inside the coronary artery to dilate it and thereby split the plaque which has caused the artery to narrow. One complication associated with PTCA is restenosis, rehardening and renarrowing of the dilated area, which occurs in about 40 ~ 60% of the patients. A recently developed method of prevention is the deployment of a stent, a stainless steel mesh tube that is left in the lumen of the vessel post-operation. This is a preliminary study using porcine models to develop and evaluate the tractability of a new low pressure deployment stent, the LPSTENT, in conjunction with a new monorail delivery balloon catheter in vivo. The effects of the delivery process on the structural and metallurgical characteristics of the retrieved stents were examined following each individual experiment and served as the basis for modification of stent and delivery system design. Final stent specifications are reported. Further studies will determine the effectiveness of the LPSTENT in the reduction of long-range restenosis rates associated with coronary stenting against competitor stents.

AN INVESTIGATION INTO THE TRANSIENT ELECTRIC FIELDS ARISING IN RESPONSE TO A POTENTIAL DIFFERENCE BETWEEN METALLIC BIOLOGICAL MATERIALS AND THE IN VIVO ENVIRONMENT

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Mentor
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Using the Scanning Electrochemical Microscope (SECM) developed by Dr. Jeremy Gilbert and associates at Northwestern University, this project investigated the electrochemical interactions between metallic biological materials and the body environment. All experiments involved a potential step of +100 mV applied to the sample metal. This application is not uncommon in the interaction of biomaterials with the human body. Previous investigations have shown that an instantaneous corrosion or scratching of the thin oxide layer on biomaterials can lead to sharp potential changes. Moreover, cardiac pacemakers and other cutting-edge medical devices employ sharp steps in potential as a means to treat a widening range of illnesses. In our experiments, resultant transient electric field patterns were observed at different sample electrode starting potentials, detector probe potentials, and probe-sample distances. Results indicated a steady current drop-off as distance from the sample metal was increased. Probe potential had a small effect on probe current response within the potential range investigated. Transient electric field trends were highly influenced by sample electrode starting potentials. These particular relationships become especially important as doctors, engineers, and scientists attempt to better understand electrical stimulation of biological tissues.

FURTHER CLASSIFICATION OF THE NEGATIVE REGULATORY DOMAIN (NRD) OF HEAT SHOCK TRANSCRIPTION FACTOR 1

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Heat shock or stress-induced proteins are essential to the survival of a cell while undergoing stressful conditions. Upon heat shock or other forms of stress such as heavy metals and oxidative reagents, heat shock factor 1 (HSF1) is translocated to the nucleus, assembles into a trimer, binds to the heat shock gene promoters, and becomes phosphorylated. The transcription of heat shock proteins, including hsp70, then proceeds. HSF1 is composed of 503 amino acids. It has an amino terminal DNA binding domain (DBD), a trimerization domain made up of leucine zippers 1-3, and a leucine zipper 4. The negative regulatory domain (NRD) is found in amino acids 181-227 of HSF1. The carboxyl terminal activation domain (AD) is found in amino acids 395-503. Previous studies have shown that the AD overexpressed in cells leads to full transcriptional abilities. We will use the plasmid construct, GST-TBP for the overexpression and purification of the TBP protein. Using the purified TBP we will determine how the activation domain interacts with the basal transcription machinery which regulates the transcription of heat shock genes

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ESTROGEN REGULATION OF MCP-1 (MONOCYTE CHEMOATTRACTANT PROTEIN-1) LEVELS IN DERMAL WOUND HEALING

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Humans tend to overheal as characterized by an excess of scar tissue. Too much wound healing can alter tissue architecture and develop into health problems of concern. Limiting wound healing would not only prevent unnecessary health problems, but also prevent visually unpleasant scarring. Macrophages respond to these sites of injury, recruited by the chemoattractant cytokine, Monocyte Chemoattractant Protein -1 (MCP-1). Previous studies in our laboratory reveal that pregnancy levels of estrogen can diminish scar tissue production and decrease the amount of MCP-1 produced by macrophages in the peritoneal cavity. Herein, we investigated the role of estrogen in regulating dermal wound healing by altering the circulating level of estrogen, giving mice punch wounds, and examining dermal wound healing and MCP-1 production. Using MCP-1 ELISA, Bradford Protein Assay, and Northern analysis of mRNA levels in dermal wounds, the relationship between estrogen and MCP-1 was quantitatively calculated. In addition, dermal wounds were examined histologically for a visual progression of the healing process. Through this, the role of estrogen regulation of MCP-1 levels in dermal wound healing was investigated.

IS THERE TOLERANCE OR SENSITIZATION TO ACUTE DOSES OF AMPHETAMINE?

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This study was designed to determine if tolerance or sensitization develops over two acute doses of amphetamine in a two month period. Tolerance is defined as a decreased response to a drug and sensitization is defined as a increased response to a drug over repeated administrations. This study was part of a larger study that examined the effects of the menstrual cycle on response to amphetamine. The hypothesis of this larger study is that the drug effects will change based on the menstrual phase. However, if sensitization or tolerance occurs, the effects may not be because of the phase but because of the new response to the drug. Sixteen women participated for 4 sessions. On two sessions they received a 15-mg dose of amphetamine and on two sessions they received placebo. Drug administration was double blind with a randomized start order. Every half-hour they were given a questionnaires testing for the subjective and psychomotor effects. Physiological effects were also measured. It was hypothesized that there would be no tolerance or sensitization to amphetamine. Preliminary results confirmed the hypothesis. Repeated measures analysis (ANOVA) on euphoria, stimulation, and heart rate have shown that there are no significant changes in effect between the sessions.

CREATIVITY AND FORMAL EDUCATION

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Everyone has their own opinion on what creativity is, ranging from something only artist and musicians posess to a capibility inherent in all humans. The most commonly used definition is one developed by Dr. Mihalyi Csziksentmihalyi, who defines creativity as taking the step in a domain that no one has taken before. While most

definitions are different, they all tend to have some reoccuring themes. The purpose of this project is to define creativity using the words of high school students, and then use this definition to find ways it can be incorporated into all classrooms. By discussing educational experiences with high school students, and using the grounded theory technique for qualitative data to analyze the discussions, we started to determine what elements of creativity are missing, and looked to reincorporate them back into the classroom. We also compared these results with those proposed by psychologists and other educators, and found that while they might also have stated the same things, their emphasis was more on techniques and external factors, while we found the common thread to be the outlook of the teacher.

PEPSI: A COMPARATIVE OVERVIEW OF THE MARKET

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"PepsiCo Inc. and Suntory Ltd. based in Tokyo have joined forces to supply the Japanese market. Suntory will be franchised to sell PepsiCo products and plans to expand its cold beverage business by 30% through March of 1999" (Foodservice Yearbook International, 10/13/97). Currently Pepsi owns nine bottling operations in Japan. As of January 1998, all Japan based franchises were sold to Suntory. The purpose of this project is to see what changes in Pepsi's advertisement and package design are needed in order for Suntory to achieve its goals in the Japanese market. An in depth analysis of Pepsi in the United States as it relates to advertisement and package design will be surveyed. In order to make the proper changes, an analysis of the carbonated beverage culture as it relates to the previous components will be done on Japan as well. Through this analysis we will see if any changes are needed for Pepsi to be more successful as it moves to greater heights in Japan.

SIMULTANEOUS EXPRESSION OF MULTIPLE GENES

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The purpose of the experiment is to try to allow the simultaneous expression of two different genes. In order to do this, a second cloning site must be inserted into the given vector, pTracer. It is necessary to use commonly used restriction enzymes for cloning such as EcoRI and BamHI. Unfortunately, these two enzymes are already used in the original (first) cloning site. Therefore, it is required to use an asymmetric cutting restriction enzyme, such as BspMI. One advantage is that BspMI is not present elsewhere, making it unique. Secondly, a cut with BspMI can produce any desired four base-pair overhang. The sticky end of this can be replicated with EcoRI or BamHI. The procedure has been laid out and is in the intial stages of experimentation.

FERMILAB EXHIBITS ON THE WORLD WIDE WEB

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The Leon M. Lederman Science Education Center at Fermilab is a place for people of all ages to go and learn about physics. Throughout this year, I worked on making these exhibits presentable on the web, so that people

from all over the world could have access to them. The Particle Families exhibit was my main focus. JavaScript was used to make the game interactive. There are both frames and no frames versions. Both versions are compatible with all current browser versions. I designed the site so that it was a game, with a high score list and the ability to keep track of your previous scores. The high score lists were written using MacPerl. The site was also designed so that later exhibits could easily be put into the same format.

PTEN GENE AS A TUMOR SUPPRESSOR THROUGH ALTERATION OF TUMOR FOCAL ADHESION

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Deletion in the regions of chromosome 10q23 in over ninety percent of glioblastomas has led to a discovery of a possible tumor-suppressing gene designated PTEN (Phosphatase and Tensin homolog deleted on chromosome 10). Analysis of the gene revealed that it is a homology to protein tyrosine phosphatases as well as cytoskeletal proteins such as tensin. The PTEN's homology to tensin and phosphatase suggests that it may control cell adhesion and signal transduction of cells. Cell adhesion, through different signal transduction, is responsible for controlling the differentiation, proliferation, and migration of cells. I have used two glioblastoma cell lines, U373 and U251. U251 has a deletion of the PTEN gene, while U373 has the intact gene. Therefore, there should exist a difference between the cellular behavior of these two cell lines. I have observed the differences between the focal adhesion of the glioma cell lines that may be caused by the deletion of PTEN by immunofluorescence microscopy using monoclonal anti-vinculin antibody. Furthermore, I studied the migration and cell proliferation rates of U373 and U251. Through this project, I have attempted to elucidate the function of potential tumor suppressor gene PTEN in glioma cells.

ALTERATIONS TO LIMIT HEART DEFECTS IN DEVELOPING MICE EMBRYONIC HEARTS

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"Where do babies come from?" As kids, our imaginations and curiosities provoked us to ask many questions involving infants. At that time, little did we know that one out of every one hundred babies are born with heart defects. Today, after thirty years since the evolution of Molecular Biology, we find ourselves asking the question, "Where and what is causing these innocent lives to be born with life threatening conditions?" After many years of research, we have accumulated the knowledge that by perturbing specific receptors, we can modify the embryonic heart. Using the Polymerous Chain Reactions, we identify which receptors are present in the embryonic heart of a mouse. The transgenes are then used to alter the expressions of the receptors so that we can control the levels of these receptors. The results then help us answer questions of early heart defects. Biomedical research has developed a great deal in the last 20 years, allowing us to ask specific questions concerning the embryonic heart defects.

DETECTION OF MYOSIN LIGHT CHAIN IN MOUSE HEART OUTGROWTHS AND FGFR3 IN MOUSE BLASTOCYST OUTGROWTHS USING IMMUNOCYTOCHEMISTRY

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Immunocytochemistry was used to detect the presence of Gribroblast Growth Factor Receptor-3 (FGFR-3) in blastocyst outgrowths and myosin light chain in heart outgrowths of mouse embryos. FGFR-3 is a receptor that helps dictate the growth of preimplantation embryos in developing embryos. By staining these outgrowth cells through a series of incubations in antibodies, we detected FGFR-3 in the extraembryonic cellular masses, namely the cells that would later become the placenta and the yolk sac of the embryo. By using these mouse outgrowths as a model for the actual embryo, we can hypothesize that the embryos of both live mice and humans will behave accordingly.

EFFECTS OF ESTROGEN ON NITRIC OXIDE SYNTHASE EXPRESSION IN THE ADULT RAT BRAIN

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Nitric oxide synthase (NOS) is an enzyme that produces a toxic gas which has been shown to act as a neural messenger, nitric oxide. NOS has been shown to be co-localized with NADPH-diaphorase. In a study to determine the effect (if any) of the female hormone, estrogen, on cells which express NOS in various regions of the brain, female rats were ovariectomized and supplemented with either no hormone or estrogen. It was hypothesized that, in brain regions containing both NOS cells and cells which express estrogen receptor, estrogen would increase the expression of NOS. In an attempt to prove this hypothesis, thin sections of the experimental and control rat brains were stained for NADPH-diaphorase. Diaphorase positive cells were counted in the hippocampus, cerebral cortex, and hypothalamus. Mean cell counts will be analyzed using a student's T-test to establish the statistical significance of any differences found. Estrogen effects on NOS expression may have effects on neural function and cognition.

TOWARD THE SYNTHESIS OF TETRACYCLIC QUINOLONES: THE SYNTHESES OF AMINO ACID DERIVED PIPERAZINES

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Mentor
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Agents that function as DNA gyrase inhibitors kill bacteria by preventing the replication and storage of double stranded DNA. It is known that certain functional groups on the fluoroquinolone nucleus are partially responsible for its biological activity. The C-7 piperazine substitute and associated derivatives have been studied, but the effect of substitution placement and chirality has not been well established. It is also unclear what role different functional groups and their positions on the piperazine play in determining the activity of the antibacterial agent. Our overall strategy in synthesizing tetracyclic quinolones is to enable the piperazine moiety to be bound in a rigid conformation, such that the importance of functional groups and their relative positions in space can be observed. This study should eventually lead to a more comprehensive understanding of the molecular mechanism of action of this class of antibacterial agents. Our project is focused on the synthesis of substituted piperazines from two commercially available chiral amino acids. Each piperazine will ultimately become a C-7 substitute on a common quinolone nucleus being synthesized by a post-doctoral fellow in our laboratory. Once these agents are synthesized, purified and appropriately characterized, they will be tested for relevant antibacterial activity.

CONSTRUCTION OF SiC MICROPIPETTES: FEASABILITY TESTING

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Mentors

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Twenty pieces of CVD silicon carbide fiber (with diameter approximately equal to 120 microns) were cut from a longer length of fiber. To be sure that the cuts were extremely straight, a diamond was used to cut the fiber. The pieces were then placed in a plasma furnace and heated to 900°C for four hours. Because the fibers are composed of a carbon core coated with a fairly uniform thickness of SiC, the carbon core should oxidize in the furnace, and only the SiC shell should remain. The results, possible further studies, and future uses of the micropipettes will be discussed.

PEMPHIGUS VULGARIS - IDENTIFYING THE ANTIBODY BINDING SITES

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Pemphigus Vulgaris is a lethal, auto-immune blistering disorder of the skin. At the present moment, there is no cure for this disease, and unfortunately, very little is even known about it. What is known is that the body's own defense system, specifically the antibodies, attacks a type of skin protein known as the Pemphigus Vulgaris Antigen (PVA). The purpose of the research is to identify the antibody binding sites on the PVA. A large region in which the binding takes place has already been identified, and so tests of the different areas within this region are being done in order to pinpoint the sites. To do this, molecular biology, protein chemistry, and a variety of immunological techniques are used. In the presentation, the exact procedure being used as well the overall implications of the research will be discussed.

DETERMINING DISCRETE DIFFERENCES IN MICROSATTELITES AND CHROMOSOME ARM LENGTH RATIOS BETWEEN SPIDER MONKEY (GENUS ATELES) SPECIES AND SUBSPECIES

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Two types of analysis were used to develop methods of identification between species and subspecies of Spider Monkeys. These were Microsatellite analysis and chromosome arm length ratios analysis. Microsatellites are tandem repeats of sequence, only a few base pairs in length, and the analysis of them is the comparison of the number of repeats found in individuals or groups. Chromosome arm-length ratios are obtained by measuring the first and sixth pairs of chromosomes for individuals from different species, and making ratios of the short upper arm over the longer lower arm. All four of the species of Spider Monkeys were involved in this project: Ateles fusciceps, A. geoffroyi, A. belzebuth, and A. paniscus. These techniques will be used in conjunction with other methods of analysis, such as mitochondrial DNA analysis using RFLPs (Restriction Fragment Length Polymorphism) and Karyotyping. Microsatellites and arm-length ratios should provide more insight into hybrids and back-crosses than other methods, when combined with the other methods of identification.

AGENT-BASED MODELING AND OBJECTIVE-C PROGRAMMING

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Efforts to accurately modeling societies and consequently developing a unified theory concerning changes in culture have long been hindered by an inadequate understanding of human interaction, behavior, and history. One way to overcome this barrier is by using agent-based modeling, an implementation where certain "rules" are programmed into a virtual individual, defining the behavior of that individual towards other individuals and towards the surrounding environment. These individuals are allowed to "tinker" with parts of their environment and culture. When successful, this can lead to widespread cultural evolution and may have a dramatic impact on the organization of the society. The platform of choice to employ such agent-based modeling is Swarm. Developed by the Santa Fe Institute, Swarm uses GNU Objective-C, a powerful fully object-oriented programming language. Learning and coding in Objective-C will be discussed as an example of object-oriented programming, as well as a demonstration of Swarm and agent-based modeling.

DEVELOPMENT OF AN ELISA ASSAY SYSTEM FOR THE DETECTION OF MOUSE ANTI-HUMAN CD30L ANTIBODIES

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Mentor
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Mice were injected with laboratory-produced P815.mock-transfected cells, P815.CD30L cells, and CD40 cells. The animals exposed to the P815 cancer cell line subsequently developed tumors and were sacrificed after 17

days. To examine immune responses, serum was collected from each animal and analyzed. An ELISA assay system was developed to detect the presence of anti-human CD30L antibodies in serum of mice. To reduce the high background in this assay system, $F(ab)_2$ fragments were generated by cleaving off the constant region of OKT8 molecules. To test the success of the cleavage, multiple ELISA assays were conducted and the presence of pure $F(ab)_2$ fragments was verified. Subsequent alterations to the ELISA assay system were made to improve its efficiency. Modifications on the concentrations of anti-CD30L antibodies, serum, soluble CD30L, and secondary antibodies were made. Results, at present time, are inconclusive due to the presence of a high background. Further testing with improvements on the assay system is need for a thorough conclusion.

THE ASSOCIATION OF PROTEIN PHOSPHATASE-2A WITH TUBULIN AND ACTIN COMPONENTS OF THE CYTOSKELETON IN LEWIS LUNG CARCINOMA CELLS

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Metastatic (ln 7) and non-metastatic (C8) strains of Lewis lung carcinoma cells in mice were stained for different components of the cytoskeleton with antibodies and inspected under an immunofluorescent microscope. Cells were either free-floating in media or grown into spheroids to model a true cancerous environment. They were stained for tubulin and actin, components of the cytoskeleton, and protein phosphatase 2-A, responsible for the dephosphorylation of cytoskeleton. Tubulin and actin staining produced defined images resembling beehive structures, especially concentrated where cells were touching each other. Phosphatase staining appeared clear around the edges of cells and speckle-like on the cytoskeleton. C8 cells consistently appear more organized than ln 7 cells because of increased cytoskeleton organization, likely due to the activity of protein phosphatase-2A. The removal of the phosphate group from the cytoskeleton aids in the connection of microtubules, making the cytoskeleton more rigid and defined. This supports the claim that increased levels of PP-2A leads to less invasive cancer cells. The activity of PP-2A elevators and inhibitors and their effect on the structure of microfilaments will also be discussed.

EFFECTS OF TRANSFORMING GROWTH FACTOR β (TGFβ) ON RECOMBINATION-ACTIVATING GENES (RAG) FUNCTION IN HUMAN T-CELL MATURATION.

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Mentor

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A majority of T-cells develop in the thymus through a complicated process that involves several distinct stages in which the maturing T-cells can be distinguished by their cell surface markers. One of the important steps in the T-cell maturation process is the rearrangement of the T-cell specific marker, the T-cell receptor (TCR). The rearrangement of TCR is regulated by two enzymes RAG-1 and RAG-2. Previously, Dr. Le's laboratory has shown that TGFβ selectively modulates the expression of RAG-1 and RAG-2; however, it is not known whether these changes result in altering RAG-1 and RAG-2 function. Thus, our objective is to determine whether TGFβ affects RAG-1 and RAG-2 function in a distinct stage of maturing T-cells. To do this, we took several thymocyte samples and isolated cell populations in different stages of maturation. Using antibodies for the CD1, CD3, CD4, CD6, CD8 and CD34, I sorted these cell populations using Fluorescence Activated Cell Sorter (FACS) analysis and collect cells at distinct stages of their maturation. Now that we have our populations isolated, our next step

will be to culture the isolated T-cells with TGFβ and directly determine the effect of TGFβ on the TCR rearrangement in the developing T-cells.

SELECTION FOR CALCIUM RESISTANT DROSOPHILA

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The addition of metal ions to tissue will force the tissue cells to compensate for the lack of an equilibrium by altering the ion flow across the membrane. For example, when providing Drosophila larvae with an environment containing a concentration of 12.5 mM $CaCl_2$, all of the larvae observed expired in the time span of one week, displaying that wild type Drosophila are unable to live in an environment containing an excess amount of calcium. In an attempt to discover whether a mutation can occur which would counter the before-mentioned hypothesis, a selection experiment was performed. A collection was made of isogenic X adult male Drosophila and they were mutagenized via gamma ray irradiation in order to create mutations in their chromosomes. The males were then crossed with wild type virgin female Drosophila and were left to mate on an apple juice agar plate containing a concentration of 12.5 mM $CaCl_2$. The Drosophila are going to be given time to continue mating to select for larvae which are resistant to a calcium enriched environment.

RECURRENCE QUANTIFICATION ANALYSIS OF EXONS AND INTRONS

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Eucaryotic DNA is characterized by alternating segments of exons and introns. Exons code for specific sequences of amino acids which are eventually assembled into protein structures, whereas the introns have no known function. It is hypothesized that DNA exons and introns possess different mathematical patterns that can be discerned using nonlinear techniques. Genomic data on the human alpha-albumin and human beta-globin were downloaded from Genbank and Protein Database of the Brookhaven National Laboratory. DNA regions were parsed into exons and introns and each of the four bases were assigned values of Gibbs free energy, entropy, or enthalpy. Patterns of encoded exons and introns were studied mathematically using Recurrence Quantification Analysis (RQA) in the fifth embedding dimension. The best discrimination between exons and introns was obtained using enthalpy encodings. Exons were revealed to be much more heterogeneous in structure than introns. These results demonstrate the potential utility of RQA in locating genes within long, but unmapped sequences of DNA, such as in DNA data strings generated from the Human Genome Project.

ANALYSIS OF OVARIAN AND HUMAN CHORIONIC GONADOTROPIN (hCG) ANTIBODIES IN WOMEN WITH RECURRENT SPONTANEOUS ABORTION

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Certain types of infertility (which affects 10%of the population) are associated with autoimmune mechanisms. We have previously shown that ovarian antibodies (OVAB) are found in 50-60% of the serum of women with premature menopause and unexplained infertility. Furthermore, phospholipid and thyroid antibodies have been associated with spontaneous recurrent abortions. The objective was to evaluate women who have had recurrent abortions for OVAB to determine if they also had ovarian autoimmunity. A second objective was to test for antibodies to hCG because of its role in maintaining the corpus luteum after fertilization. Our study consisted of a group of women with a history of recurrent abortions (N=33), a control group of women who had never been pregnant (N=10), and a group of men (N=7). OVAB and hCG antibodies were detected using a standard enzyme-linked immunoabsorbant assay (ELISA). It was found that 15% of the group of women with recurrent abortions and none of the control or male groups were positive for ovarian antibodies ($p<.05$). It was also found that 33% of these women, 10% of never pregnant women, and 14% of the males were positive for hCG antibodies ($p<.01$). This data suggests that ovarian antibodies may not have a significant association with recurrent abortions. However, antibodies to hCG are present and may interfere with pregnancy in some cases.

EXAMINING FRIENDSHIP NETWORKS AT IMSA

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Last year, a three-page survey was administered to every student at IMSA. The response rate was approximately 85.9%. The survey instrument was divided into two sections: the first asking questions about the respondent's academic, social, and ethnic background and future aspirations, and the second asking the respondent to list up to sixteen current friends, as well as where and how they interacted with those friends. This year has been spent coding these results into numerical form in order to analyze them by the computer program Kliquefinder. Theories on the results thus far and their reflections on the IMSA community will be discussed.

USING WORK MEASUREMENT FOR PRODUCTIVITY IMPROVEMENTS AND LABOR BUDGETING/ UTILIZATION OF INCREASED PROFIT WITHIN THE CORPORATION

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Project Fresh Start is designed to increase efficiency and productivity in the Chicagoland-based Dominick's Food Stores. Our involvement with this program has been on two levels, the first of which was researching time standard values for general store activities. This was used in conjunction with previously determined time values for simplistic actions to create a directory of store operations and their time standards. These standards were used to optimize the efficiency of labor hours and thereby increase company profit. The second phase was in determining the placement of these profits. The question was raised as to whether they should be taken off the top as profit or reinvested in the company. A marketing survey was designed to measure customer satisfaction in a experimental store in which the money was being reinvested. There is ongoing work to determine the profitability of reinvesting the money. Simultaneously, several new methods have been installed in the experimental store that have significantly increased labor efficiency. These methods were outlined in a training program using a computer medium and will be "rolled-out" to other Dominick's chain stores

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THE ROLES OF WHITEWARE VS. REDWARE IN NORTHERN ANASAZI SOCIETY

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Northern Anasazi ceramics are categorized into typologies and wares, according to decorative motifs and surface color, respectively. Due to their stylistic attributes, potsherds are widely used to help in such endeavors as establishing a site's chronology or determining intersite commerce. However, little research has been conducted on the functions of the ceramic itself, in regards to the social, ritual, or domestic roles assigned to different wares. This topic is the focus of this mentorship. The distribution of redwares and whitewares from two major areas of the Four Corners was tabulated: the Kayenta and Mesa Verde Regions. After analyzing the data in both intersite and intrasite contexts, the frequency of decorated wares at kivas (ceremonial structures), residential rooms, burials, trash deposits, and geographical regions will be examined. By doing so, information on the differences or similarities in the roles of Anasazi redware versus whiteware will be discerned and presented.

GÖDEL, ESCHER, BACH: A STUDY IN FORMAL SYSTEMS AND ARTIFICIAL INTELLIGENCE

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Understanding and manipulating formal systems and meaning is the key to creating artificial intelligence. The computer, the most-likely candidate to become intelligent, is a formal system consisting of axioms and rules on multiple, yet distinct levels. It must follow electrical rules on transistor and digital gate levels, and logical rules on the software level. The hardware of a computer is much like the physical makeup of the brain, in which information is processed through switches between "on" and "off." Electrical impulses control highs and lows on the digital gates of a computer, and determine if and when neurons fire in the brain. The information processed is the software of both systems and, in turn, creates recognizable patterns on the next level. Every level in a computer, however, is completely identifiable and independent of the others. The human mind, on the other hand, processes information through countless interdependent, intertwined levels. Somehow this infinite recursion and complex dependency creates meaning. To create intelligence in a computer, we must program it to simulate this recursion and extract meaning like the human mind.

THE EFFECTS OF ANDROGEN ON NITRIC OXIDE SYNTHASE EXPRESSION IN ADULT RAT BRAINS

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Nitric oxide synthase (NOS) is an enzyme which produces nitric oxide, a gaseous neural messenger. NOS has also been shown to be co-localized with NADPH-diaphorase. In order to determine the effect of the male hormone, testosterone, on NOS levels in various brain regions, male rats were either castrated or left intact. It was hypothesized that testosterone would increase expression of NOS only in brain regions which contain both testosterone receptors and NOS, therefore thin sections of the experimental and control rat brains were stained for NADPH-diaphorase. Cells were then counted in diaphorase positive brain areas, such as hippocampus cortex and hypothalamus. Mean cell counts are going to be analyzed using a student's T-test to determine statistical differences. Hormonal effects on NOS expression may have implications for neural transmission and therefore cognitive functions.

WHERE DO THEY GO FROM HERE? THE LONGITUDINAL STUDY OF IMSA GRADUATES

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IMSA's Longitudinal Study is a post high school graduation study which highlights IMSA graduates' academic, professional, and personal pursuits, satisfaction with high school and college, academic preparedness, cognitive habits of mind, and civic responsibility. All IMSA graduates are contacted one year, four years, seven years, fifteen years, and twenty years after high school graduation and are asked to respond to a brief series of interview questions. IMSA graduates' responses are compared to responses of other similarly high achieving students, including a cross section of Illinois honors students and graduates of specialized mathematics and science schools from around the country. After eight years of data collection, several trends have been identified: IMSA graduates earn a much higher percentage of math and science majors than college graduates nation wide; IMSA students are more satisfied with their high school experience than are comparison students, but comparison students rate their college academic experience more favorably than IMSA graduates; and IMSA graduates are very active in volunteer, civic improvement, peer tutoring, and campus government organizations. Results of the this year's are available upon request from the Research, Evaluation, and Development Office.

IS PHYSICS THE WAY TO CHEAT IN BASEBALL?

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Prompted by purported cheating scandals in baseball, an experiment was designed to determine if altered baseball bats are able to hit baseballs farther than a regular solid bat. The hypothesis was that there was a way to alter a bat so that it can hit a ball farther. In past work, it was determined that a hollowed bat was indeed able to hit the ball farther than a regular bat, when the ball was hit at the bat's center of percussion. An engineered batting device, powered by a spring to deliver constant total work to every bat, was used to hit balls off a batting tee. In the new experiment, different locations on the bat were tested away from the center of percussion, and aluminum bats were added. Average distances that each bat hit the balls were compared, and from this, it was inferred that the hollow bat hit the balls significantly farther at the most points on the bat. A human experiment was added this year, but the results were not statistically significant.

ALTERATIONS AND ENHANCEMENT OF ANGIOGENSIS IN HEALING WOUNDS

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Angiogenesis, the growth of new blood vessels, is a vital part of the wound healing process. In a wound, angiogenesis continues until the number of new blood vessels exceeds that seen in normal skin. This is followed by a decline to normal density. In aged persons, wound healing is impaired, possibly due to decreased angiogenesis. To examine this possibility, the rate of angiogenesis in old mice was compared to that of young mice. Angiogenesis was found to be significantly impaired in aged mice, suggesting that increasing the angiogenic response could be beneficial. Thus, in an attempt to enhance wound angiogenesis, a collagen-growth factor dressing was applied to wounds. Although the experimental wounds did indeed exhibit greater angiogenesis at day 7 than the control treated wounds, experimental wounds also showed less epithelialization than control wounds. In summary, the results suggest that the angiogenic response decreases with age. However, more research is needed to find a treatment that will augment the angiogenic response without compromising other aspects of wound healing.

THE MISSING LINK: CONNECTING THE HISTORY OF FILIPINO IMMIGRATION TO PRESENT-DAY FILIPINO-AMERICAN CULTURE

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Because of the high degree of "Americanization" that took place during the United States' years in the Philippines, immigrant Filipinos easily integrated in American society; but a consequence for many first-generation Filipinos is that they are ignorant of their family's history and of the Philippines as a whole. This presentation chronicles a short history of the waves of immigration from the Philippines as well as modern Filipino-American culture in the hopes of raising awareness of Philippine culture in the United States and is intended as a supplement to the Field Museum's exhibit commemorating the Philippine centennial.

PURIFICATION OF VIRACEA, A NEW DRUG USED TO BATTLE THE HERPES SIMPLEX-1 VIRUS

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Many people are at some time exposed to the Herpes Simplex Virus (HSV), but most do not show any symptoms of infection. However, the virus may be fatal for people who have weak immune systems. Some mutants of HSV develop into strains of virus that are fully resistant to today's treatment drugs, making them virtually useless after a few months. Therefore, the capabilities of a recently discovered drug , Viracea, are being tested in conjunction with the University of Chicago's Microbiology Department. Primary research addressed the tedious process of purifying the drug to find out how the drug interacts with the virus. First, liquid chromatography was used to break the drug down into fractions, and then the drug was applied to a culture of infected cells to watch for activity, or decline in viral growth. Once a trend in activity among certain fractions of the drug was spotted, more tests were run to attempt to isolate the active ingredients in the drug. This work increased understanding about purifying Viracea, but a full analysis including spectography and examination of the actual molecular structure of Viracea could take years to complete.

AFRICAN PYGMY PEOPLE AND THEIR VILLAGER RELATIONS

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The African Pygmy People of equatorial Zaire were once an autonomous group of hunter-gatherers, but as time passed and the Pygmies came into greater contact with villagers that reside in the surrounding areas, they became further involved with the villagers in economic exchanges, social phenomenon, and eventually adopted some of their religious practices. This increased contact has introduced the Pygmies to various changes in technology and

subsequently altered their culture. However, the majority of Pygmy ideology and practice have not changed over time, and the static facets of this culture reveal as much about the Pygmy society as the dynamic ones offer.

LAB EXPERIENCES IN COMPARATIVE MEDICINE

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Various surgeries and lab experiments run by the comparative medicine team at Loyola University Chicago were observed and participated in. These included heart-bypass surgery, angioplasti, endoscopy, necropsy dissection, heart-worm testing for canines, and basic laboratorial procedures. Also, simple surgical techniques were learned such as suturing, tieing knots for stitches, and blood drawing. Furthermore, a basic background in general microbiology, hematology, veterinary diagnostics, clinical parasitology, and virology. Tours of various medical facilities in the vicinity were taken as well. Such facilities included the Strich School of Medicine, VA Hines, Brookfield Zoo, and several microbiology laboratories. The final concept that was learned was to collect bacteria samples, culture the samples, and to classify the various bacterium that were found. This was done using an agar solution, nutrient broth, petri dishes, and sterile cotton swabs.

SITE -DIRECTED MUTAGENESIS OF S100§ PROTEIN: A STRUCTURE-FUNCTION STUDY OF ITS ROLE IN ALZHEIMER'S DISEASE.

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Alzheimer's is one of the diseases responsible for neuronal death in elderly patients. Not much is known about the neuropathology of Alzheimer's disease. One feature of the disease is the presence of plaques, which are deposits of amyloid § protein, in the patient's brain. High amounts of the S100§ protein have also been found in these plaques. It has been found that the high concentration of S100§ is associated with neuronal death. The exact mechanisms of S100§ neurotoxicity are unknown. We know that S100§ can exist as either a monomer or a dimer, and that it can activate cells of the brain. In order to study S100§ further, we made a deletion mutant of the protein. We want to know whether the amino acid residues we have deleted may be responsible for any of these functions of the protein. The C-terminal portion of S100§ contains amino acid residues which have hydrophobic characteristics and residues used in dimer formation, both of which may be functionally important. Using site-directed mutagenesis, a stop codon was introduced at position 83, which results in the loss of 9 amino acids from the C-terminus. Through recombinant procedures, the mutant protein was made, and is now ready to be studied in functional assays.

URINARY MODIFIED NUCELOSIDE LEVELS IN BRAIN TUMOR PATIENTS

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This project is a continuation of last year's study to determine whether urinary modified nucleoside (MN) levels in brain tumor patients can be used in a clinical setting for diagnostic and/or prognostic purposes. Pseudouridine (Ψ), 7-methylinosine (m^7I), and 1-methyladenosine (m^1A) are the three MN's which were analyzed. Pretreatment values of glioblastoma multiforme (GBM), mid-grade glioma (grades II-III), and meningioma patients were examined against healthy population groups, including pre-treatment values of a group of non-tumor craniotomy cases. Our preliminary findings, as shown in last year's research and presentation, were inconclusive. However, upon completion of this project, we report the following: (1) there is a significant difference in m^1A values of meningioma patients vs. healthy control, (2) the Wilcoxun Test has shown a meaningful difference between the survival rates of low excretors vs. high excretors in GBM and mid-grade glioma patients, and (3) these findings have engendered a further study to determine the differences in brain tumor gene expression between high excretors vs. low excretors of GBM and mid-grade glioma tissues by using Differential Display Reverse Transcriptase Polymerase Chain Reaction (DDRT-PCR).

IDENTIFICATION AND CLASSIFICATION OF OBJECTS IN COMPUTER VISION

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Computer vision attempts to create programs to analyze and understand images from a visual environment. In this particular system, individual computing procedures, called modules, were assembled into a structure known as a pipeline. The pipeline inputs images from a digital camera and compiles them to perform such functions as object recognition and background elimination. The purpose of our experiments was to create useful modules that could later be used for other projects. One module that we developed was the Hough Transform, an algorithm for identifying shapes. Using pixel information and a look-up table for the shape, one can use the intensity of the pixels and how they are changing to identify arbitrary shapes in a picture. This algorithm will eventually be used to recognize how many fingers are being held up in a picture. Another module, the Hausdorff distance, was written to measure how closely two images match each other, and it can be used for object recognition. We also wrote modules for edge detection and color histogramming. Our paper will describe these modules and show how they were implemented and can be used in a bigger system.

DETERMINING PROTEIN-LIGAND BINDING AFFINITIES USING PULSED ULTRAFILTRATION

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Determining ligand-protein binding strength is important in understanding how ligands and proteins interact together. Pulsed ultrafiltration is a new method aimed at doing just that, by pulsing an aliquot of ligand through a stirred chamber containing a macromolecule held in place by a semipermeable membrane. As the ligand passes through the chamber, it slows down somewhat because of its interaction with the macromolecule. This retardation can be measured and compared to a control experiment without the macromolecule, and can be used to determine the binding constant and number of receptor sites. Several experiments were performed using Pulsed Ultrafiltration in order to determine the binding affinity between a ligand and a protein, generally Human Serum Albumin. Several things will be discussed, including the results of these experiments as well as a discussion of the method itself, including recent modifications to it. Also, another project will be discussed briefly, the development of a of an *in vitro* method to model and examine the degradation of peptide and peptide analog drugs in the digestive tract prior to absorption.

RESEARCHING THE HIGGS BOSON WITH MONTE CARLO PROGRAMS

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The purpose of this research mentorship is to develop and study the methods by which researchers will hopefully discover the Higgs Boson, with aid from the Monte Carlo event generator "PYTHIA." The Monte Carlo samples will be analyzed using a graphical analysis program, PAW++. By comparing the energy distributions of various masses for the Higgs particle against the energy distributions of other events, we endeavor to distinguish between Higgs events, top-antitop events, and other types of events.

Thus far, some theoretical data has been generated which indicates methods of distinguishing the Higgs particle from top-antitop events. However, the research is far from complete. It is anticipated that research on this topic will continue well into next century.

THE QUANTUM YANG-BAXTER EQUATION

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The Quantum Yang-Baxter Equation is satisfied by matrices in certain models of scattering theory and statistical mechanics, and has been studied for over 15 years. However, very few solutions have been studied other than deformations of the identity. This project addresses Drinfeld's suggestion in 1992 to study set-theoretical

solutions, the simplest kind of solutions that are not deformations of the identity. These solutions are given by a fixed set **X** and a permutation **R** of $\mathbf{X} \times \mathbf{X}$ satisfying the Quantum Yang-Baxter Equation, which now takes the form $\mathbf{R}^{12}\ \mathbf{R}^{13}\ \mathbf{R}^{23} = \mathbf{R}^{23}\ \mathbf{R}^{13}\ \mathbf{R}^{12}$, where $\mathbf{R}^{ij}$ indicates **R** acts in the **i**-th and **j**-th components. To facilitate this study, exhaustive searches for small set-theoretical solutions were completed and analyzed by computer, which helped to gain an overall understanding of such solutions. The resulting progress is in two directions: understanding the properties and structure of set-theoretical solutions, and developing methods of constructing set-theoretical solutions.

The properties of solutions studied draw from algebra, geometry, and topology. Construction of solutions utilize both combinatorial and algebraic methods. The computer results are analyzed according to classifications given by these constructions.

EVOLUTION AND STRUCTURE OF HIV-*VPR* GENES AND THEIR POTENTIAL ROLE IN THE CAUSE OF AIDS

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HIV-1 Vpr plays an important role in causing AIDS. An online program known as NNPredict was chosen in this study to predict the structure of HIV Vpr sequences. This program predicts the protein secondary structure based on the biochemical features of each protein residue in a sequence. NNPredict takes an input of a sequence, either consisting one-letter or three-letter amino acid codes. The output is a secondary structure prediction for each position in the sequence. This program was designed based on computational neural networks, which have been proven effective in predicting secondary structure of various protein sequences. In this study, the structure of a wild type of HIV Vpr protein was compared with several mutant Vpr sequences, which contain either a point mutation or deletion. The evolution of the Vpr gene will also be examined using PHYLIP, a program which predicts phylogenic trees. Data from the phylogenic trees will be helpful in learning whether the Vpr in long term survivors is genetically different form that of intermediate and short term survivors. The result of comparing the protein structure and evolution of Vpr will help us study the effects and functions of HIV *vpr* gene and their potential roles in the cause of AIDS.

THE CONGENITAL HEART IN ITS MANY FORMS

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Heart malformation, also called Congenital Heart Disease, refers to any deformity of the heart that develops within the first two months of fetal life. Such deformities have little effect before birth because, in the fetus, cellular respiration (via the mother's bloodstream) is accomplished through the placenta. After birth, some of these deformities impair the supply of oxygen to the tissues and cause disability or death. The most common heart malformations in the infant are those in which oxygenated blood is recirculated through the lungs because of a left-to-right shunt in the heart. This condition is serious and is common among infants with Down syndrome. Even more serious are anomalies in which oxygenated and deoxygenated blood mix; the poorly oxygenated blood reaches the tissues, resulting in cyanosis (bluish coloring of the skin) and growth retardation. The tetralogy of Fallot (baby blue syndrome) is an uncommon malformation in which there is ventricular septal defect, pulmonary

valve stenosis, right ventricular hypertrophy (overgrowth) and a shift of the aorta from the left to the right side so that it receives blood from both sides of the heart. Abnormalities of the large vessels may also cause symptoms of circulatory failure but are in general less serious. Malformations of the heart are repaired by modern surgical procedures with varying degrees of success.

EXPLORING MICROSOFT VISUAL BASIC 4.0

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A series of progressively difficult problems are used as an introduction to Microsoft Visual Basic 4.0 with an emphasis on style and looped structures as opposed to brute-force, linear programming. Using recursive loops eliminates unnecessary code and simplifies the program so that it is more easily understood, which is essential when working on the level of larger programs. This tutorial began with standard introductory programs and finished with a Mandelbrot fractal program. The final fractal project reproduces the Mandelbrot set onscreen, which is one set of numbers that creates a recursive image made of smaller versions of itself, which themselves are made of smaller versions, and so on into infinity. The project is also a translation from a Java program into Visual Basic that has subsequently been improved on. In this translation process, from one code to another, the 'intention' of the program must be retained despite fundamental structural differences, much as languages are translated or music transcribed. Added features implemented in the fractal program include: zoom box, window size, and color cycling.

MULTI-CULTURAL PERSPECTIVES ON DEATH AND DYING

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Multi-Culturalism has grown to be one of America's most prominent features. More and more emphasis is being placed upon diversity and variety within all fields. Besides multi-culturalism, western medicine has probably been one of the most influential, compelling, and powerful attributes of American society. America is known to be rich, powerful, firm, and an advocate of freedom. Should America be so firm in its beliefs when it comes to death and dying? What difference does culture make at the end of life? The difference lies mostly in the value systems by which people live. The American value system, the "Standard Value System," differs greatly from those of other cultures. "American" ideals emphasize autonomy, rights, and individualism. By contrast, there are patients that do not live by that value system and traditions of family and culture take precedence. A "good death" is our common goal, yet there are conflicting ideas of a good death. When they conflict, does the doctor understand? Does the patient understand? Does the family understand? If autonomy is emphasized, does that then override tradition and family decisions? Is the integration of these ideas possible? Awareness and respect is essential to completely understanding the views of the multi-cultural individual.

DEVELOPMENT OF ILLINOIS RAPID ASSESSMENT PROGRAM

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Snails and slugs were sampled in three natural areas within the Chicago region as part of an effort to develop a rapid assessment program in Illinois (IRAP [2]). Rapid assessment programs are designed to aid in timely and effective land management decisions. Snails and slugs were chosen because snails are less mobile than traditionally sampled organisms and therefore likely to be restricted to a specific habitat within a highly subdivided urban environment. Snails and slugs are also relatively easily sampled due to lack of seasonal migration or complicated stages in life history. Soil and litter samples were collected from eleven sites in the Chicago area, including a savanna, a dolomite prairie and several high and low quality woodlands and mesic sand prairies. After the species were identified, diversity at sites with different habitats and between sites of similar habits of varying quality was statistically compared. The diversity and the distribution of species will be discussed, and examples of species that appear to be habitat specific and therefore useful indicators of habitat type and quality, will be determined.

STUDY OF THE IMPACT OF THE TOBACCO EDUCATION GROUP ON TEEN SMOKERS

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Edward Cardiovascular Institute, in conjunction with four area high schools, offers a program entitled Tobacco Education Group (TEG), for high school students found in violation of school or city smoking policies. For a small fee, students can avoid suspensions or fines by enlisting in the three-day course, which outlines the health risks of tobacco. At the beginning of the first class, students completed a survey, which dealt with such factors as age, gender, smoking frequency, attitude towards quitting, and smoking acquaintances. The participating students were also administered a survey at the conclusion of the program, and a follow-up phone interview three months later. The information collected in the surveys was tabulated and analyzed, in order to gather general statistical data on the subject, and to recognize and classify specific patterns among our area's teenage smokers. By keeping track of the progress of each student, we were able to determine how effectively the TEG program does its job.

VISUALIZATION OF VERIFICATION OF CONCURRENT SYSTEMS

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Over the course of this project, visualization system for VeriSoft has designed and implemented. VeriSoft, a tool which explores and records the state spaces of concurrent systems already had features for exploring and tracing through the state space with a debugger. However, an overall view mode was not available. Thus, a program was written to display a tree representing the state space as explored. Initially, several methods for implementing

the tree plotting tool were inspected. It was soon apparent that the first choice, a canvas widget under TCL/Tk was much too slow. Thus, the decision was made to implement the plotting function, in a tool called vs_tree, in C, using the X Window system. After working with the stand-alone version of vs_tree, the realization was made that it must be further integrated with the rest of VeriSoft in order to fulfill its full possibilities. Thus, vs_tree was converted to work as a Tk widget. This method of deployment maintains the speed of C, while offering further inter-operability with the trace view's TCL/Tk interface.

MULTITASKING SYSTEMS ON THE i386

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The goal of this project has been the designed and implementation a multi-tasking system which runs on the i386 microprocessor. This has included the design of a Virtual Machine model, a C Compiler, various atomic system library functions, and a file system.

The Virtual Machine is designed to be portable to other architectures, and yet efficient on the i386 (and others). As an interpreter, it is implemented in assembly language, using a short inner loop.

The C Compiler is necessary for easy program authorship. Research behind the theory compilers, lead to the design of a non-optimizing compiler for the C language, based on a syntax tree generated on the call stack. Further enhancements could include optimization and C++ support; the output runs on the virtual machine.

The File System, essential to a self-contained system, is designed as a single database composed of 4KB blocks. Groups of blocks are given attributes as data files or directories, and span a multiple of 4KB. Directories are simply files containing lists and pointers to other files, which are interpreted specially. Current work is on implementing this file system.

MECHANICAL ANALYSIS AND THEORETICAL COMPARISON OF CAPACITANCE GAUGES

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Fermi National Accelerator Laboratory is in the process of designing a sufficiently accurate and minimally invasive device to determine the amount of compression present on the superconducting coils of the High Gradient Quadrupole (HGQ) magnet. The purpose of this is to increase understanding of the mechanical state of these superconducting coils as assembled in the magnet. Capacitance gauges, an alternative to the lack of

efficiency and accuracy exhibited by beam gauges and Fuji Film, provide theoretical accuracy in determining the compression on these coils and simple calibration and construction while complying with the constraints of the magnet. Hence, it is proposed to increase the basis of knowledge concerning capacitance and capacitance gauges, test the capacitance gauges under various conditions while considering mechanical constraints, and compare the results to the theoretical findings, therefore determining the efficiency and accuracy of the capacitance gauge.

AN EXAMINATION OF EPOXIES CONCERNED WITH WHITE COIL DISEASE

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When conventional superconducting coils were wrapped in Volan treated glass cloth, impregnated with epoxy, and then left for a few days, they began to turn white. This phenomenon is known as White Coil Disease and brings into question both the glass cloth used as well as the strength of the bonds between the epoxy and the glass cloth. In pusuit of a solution to White Coil Disease, the strength of the bonds between epoxy and glass cloth have been brought into question, and three different aspects of the epoxies in questions have been tested - hardness, crack resistance, and tensile strength. General hardness was found with a durometer; crack resistance was measured at temperatures down to those of liquid Nitrogen (-194 degrees Celsius); tensile strength was found using an Instron Universal Testing Machine to discover the relation between stress and strain for each epoxy. Testing and analysis are yet incomplete, leaving the question of the strength of the epoxy-glass cloth bonds unanswered.

THE ROLE OF THE UNITED NATIONS IN THE CURRENT WORLD SITUATION

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The great powers of the world created the United Nations to prevent "the scourge of war" and improve the condition of all humankind. However, the Cold War overshadowed it for decades, but today, the United Nations can finally execute its powers and work towards the goals for which its founders intended. However, the world situation has drastically changed since the inception of the UN, and the UN cannot be an anachronistic structure within the changed global political landscape. Robert Cooper, eminent British diplomat, explains an interesting theory about international politics and relations in his essay, "The Post-Modern State and the World Order." The new world structure and the involvement of the United Nations in it will be explored.

NEUROMODULATION OF CYTOKINE SYNTHESIS BY T-HELPER CELLS

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The ultimate goal of our research is to understand the mechanisms by which the binding of the neurotransmitter norepinephrine to the beta-2-adrenergic receptor (β2AR) modulates the ability Th1 and Th2 cells to produce the cytokines Interferon-γ and Interleukin-4 respectively. Previous studies have shown that Th1 cells express a detectable level of the β2AR, but that Th2 cells do not. Thus, my hypothesis is that exposure to a β2AR agonist will differentially affect IFN-γ production by Th1 cells, but will not affect IL-4 production by Th2 cells. The experimental approach employed uses Brefeldin A, fluorescently-labeled antibodies, and FACS analysis to quantify both the number of cells producing cytokine and the level of cytokine produced by Th1 and Th2 cells exposed to the β2AR agonist terbutaline before and after activation. Preliminary results support my hypothesis. Future studies will employ subtype-specific antagonists to determine if norepinephrine binding specifically to the β2AR mediates a similar effect on Th cell cytokine production. These data suggest that stimuli which bind to the β2AR, such as the neurotransmitter norepinephrine, may modulate Th cell function and may play a role in the development or progression of immune-related diseases and illnesses, such as rheumatoid arthritis and the common flu.

CLASSIFICATION OF SPECIES WITHIN *ACER* SERIES *PALMATA* USING MORPHOLOGICAL AND MOLECULAR DATA

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Morphological data were collected from over 140 herbarium sheets of the species: *A. circinatum, A. duplicatoserratum, A. japonicum, A. palmatum, A. pseudosieboldianum, A. robustum, A. shirasawanum,* and *A. sieboldianum.* Data were collected from three leaves and three infructescences / inflorescences per herbarium sheet concerning leaf trait (length, width, lobes) and shoot trait variance (diameter, pubescence) among and within the species. Multivariate analysis using SYSTAT was used to evaluate within and between taxa variation and to identify cohesive groupings. Molecular variation was also studied using Random Amplified Polymorphic DNA (RAPD) markers. DNAs were extracted from five representatives of each of the key taxa, quantified with a fluorimeter and diluted accordingly for amplification using 9 10-base primers using the Polymerase Chain Reaction (PCR). RAPD markers were then analyzed using cluster analysis. Upon amplification data were collected concerning variance of RAPD markers between species. This data supplements the morphological data and any conclusions found from the data. The objective was to use the molecular data to provide a less subjective classification system and resolve discrepancies identified by the morphological data. Currently, research on this project is not yet complete.

ATP-INDUCED MORPHOLOGICAL CHANGES IN H. PSEUDOLIGACTIS

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H. Pseudoligactis (Brown Hydra) were placed in various concentrations of ATP (adenosine tri-phosphate) at .125 M, .25M, and .5 M. The hypothesis was that ATP would cause overall body elongation of the hydra within a three day period. [Stuart A. Newman. Nature New Biology, Vol. 244, No.134, pp 126-128, July 25, 1973] The addition of ATP to the environment caused visible elongation in total body length. However a great deal of the elongation occurred specifically within the gastric region and the budding region. Some elongation also seemed to occur at in the peduncle however it was very minimal. Compared to humans, hydra are very simple creatures. ATP is produced naturally in most complex organisms, however it is very minimal. Given that ATP is produced

naturally in most complex organisms, the exploration of using ATP as a treatment in the environment of hydra -- either externally or internally -- could lead to possible uses of ATP treatments which could enhance and benefit the lives of more complex organisms, even humans, in the fields of growth and development.

BIÈRE! BIER! PIWO! THE BEER INDUSTRIES IN FRANCE, GERMANY, AND POLAND

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Discovered over 6,000 years ago, improved by monks in the Middle Ages, and enjoyed by millions of people around the world, beer is as popular as ever. In its traditional stronghold, Europe, beer makes an impressive impact as both a cultural and economic force. An overview of the brewing market is presented in three different environments: France, the undisputed land of wine; Germany, which boasts the best beer halls; and Poland, home to the best vodkas. With such diverse histories, cultures, and economies, the brewing market in the three countries have striking similarities and differences. So, whether its Löwenbrau or Okocim, lager, ale or stout, beer gives a fresh, new insight into Central Europe.

DETERMINATION OF FIBROBLAST GROWTH FACTOR RECEPTOR (FGFR) EXPRESSION IN RAT'S HEART CELL LINE BWEM

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FGF Receptors are large dimeric proteins found in heart tissue during fetal and neonatal development. These receptors are stimulated by ligands in the extracellular space, which bind to these receptors, thus causing phosphorylation of the receptors. Once phosphorylated, the receptors cause cell growth in the heart. Over the past several months, we have been trying to answer the question, "Which Fibroblast Growth Factor Receptor (FGFR) isomers are found in the heart muscle cell?" To do this, we modified the lab's protocol based on the published protocol [D.G. McEwen, Biotechniques vol. 22 no. 6, 1068-70, (June 1997)]. We isolated RNA from the heart cell line BWEM established from a rat and created cDNA with Reverse Transcriptase (RT) step using 3' primers. During the Polymerase Chain Reaction (PCR) step, we amplified the conserved sequences of the tyrosine kinase domain of the different isomers multiple times with the 5' primer. After amplification, we digested the product using restriction enzymes. By doing this, we tried to identify which of the four distinct FGFR are found in RNA isolated from rat hearts at various stages of development using gel electrophoresis. Unfortunately, the resulting bands did not match with the published results. Possible reasons will be discussed.

THE NUMBERS OF WIZARD STREET WITH CHILDREN IN CABRINI GREEN

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Concepts of area and volume are elementary when one is equipped with the necessary knowledge. These concepts are far more difficult to grasp without multiplication. Kindergarten through second grade children who live in Cabrini Green, one of the nations most impoverished housing facilities, were presented with a series of challenges that led to the understanding of area and volume. The challenges were based on Piaget's theories of association [Piaget, J and Inhleder, B and Szeminska, A. The Child's Conception of Geometry. NY., WW Norton & Co., Inc.] Challenges and outcomes will be discussed.

EARNINGS PRE-ANNOUNCEMENTS

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Corporations are required by the stock exchange in which they are listed to announce their earnings to their shareholders every quarter. Some companies voluntarily disclose estimates of these earnings before the official announcement, this disclosure is then called a pre-announcement. Our research investigates the reasons for making such pre-announcements as well as the effect upon stock prices. Preliminary research indicates that abnormally high returns can be made by buying (selling) stocks whose companies pre-announce high (low) earnings.

THE ROLE OF CORNEAL TOPOGRAPHY IN THE COMBINED PROCEDURE

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Corneal shape, a means of describing corneal topography in terms of curvature, is a critical element for the optics of the eye and hence quality of vision. In assessing the role of corneal topography during the recovery period of combined surgery (cataract extraction and glaucoma filtration surgery) patients, pre and post-operative corneal maps could be compared. Before the study began, there was a steady flow of patients (ave. three patients per month.) After the study proposal was approved, only three patients consented to participate in the study over a three month period. Since the project was hindered by a lack of participants, another study was simultaneously conducted. Upon differentiating 100 corneal topographic maps into categories like oval, round, bowtie, kidney, and undefinable, various statistical analyses were performed with the images under the following parameters: tangential with a 0.50 and 1.50 diopter (D) step size and axial with a 0.50 D and 1.50 D step size. The importance of examining corneal curvatures lay in the potential positive outcomes of applying topographic

analyses in the evaluation of prospective or current refractive surgery patients and contact lens wearers. This also assists with evaluation of patients having corneal diseases, and corneal surgeries.

SERIATION AND CHRONOLOGY OF THREE PUEBLO SITES IN THE NORTHERN RIO GRANDE AREA OF NEW MEXICO

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The potsherds excavated from three sites in the northern Rio Grande region of New Mexico were examined. These sherds were excavated from four to six test pits at each site; each pit was two meters by one meter, with fifteen centimeter levels. The characteristics examined on the sherds were maximum thickness, number and thickness of painted interior lines, and number and thickness of painted exterior lines. These characteristics were correlated between test pits at the same site, and a chronology was constructed based on the principle of seriation. Then, the chronologies were correlated between the three sites. This chronology will be presented, along with a brief explanation of the concept of seriation.

THE CORRELATION OF CRI, QI, AND BEAM

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The concept of Qi embodies a flow of energy, principally from the brain, that regulates body action. Osteopathic CRI (cranial rhythmic impulse) is a concept of brain energy flux that can be detected and quantified through appropriate manual techniques. BEAM (brain electrical activity mapping) is a two-dimensional elctroencephalography that is capable of monitoring wave-fronts of brain electropotential in real time, presenting them in a graphic (video) format that is also quantifiable in electroencephalographic parameters.

The project, The Correlation of CRI, Qi, and BEAM, was created in an attempt to attribute the meridinal movement of the CRI to the emission of electrical impulses from the brain and to compare the nature of the transmission to that of the East Asian phenomena of Qi. The movement of the CRI and Qi along internal meridians suggests an overlap of the two phenomena, possibly indicative of the independent discovery of the same phenomena by two ideologically polar medicinal doctrines. BEAM provides a hard-science underpinning. This project though not initiated presents an extremely sought after, scientifically rigorous method to assess the outcomes of a branch of alternative medicine.

CALIBRATION OF AN ACOUSTIC ANECHOIC CHAMBER

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An acoustic anechoic (echo-free) chamber is calibrated using a modified method derived from various techniques previously implemented and documented. The purpose of the chamber is to simulate acoustic free field conditions. The basis of the calibration method is centered on the inverse square law, which states that for a monopole source in a free field, the sound energy level at a given location is proportional to the inverse square of the distance from the source. Using this, the free-field deviation over the range of audible frequencies is quantified, and the cutoff frequency below which the chamber is completely incapable of simulating free field conditions because of size is found. Analysis of the calibration method and data collected is presented, along with suggestions for possible improvement of the chamber.

CONTROLLING A MICROELECTROMECHANICAL CLAMP USING THE BASIC STAMP II MICROCONTROLLER

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The Basic Stamp II is a microcontroller which runs at 20 mhz off of a 9-volt battery. This chip has 16 input output lines which can be used to control various devices and to receive input. Programs for the microcontroller are written in the PBasic language and then sent to the microcontroller via a serial cable. The clamp is a pair of microelectromechanical systems (MEMS) actuators, both 200 microns long. These miniscule actuators were fabricated in the four-level planarized polycrystalline silicon process When current up to 14 volts and 5 milli-amps passes through the actuators, they will both deflect up to 16 microns towards each other.

To control the clamp, the Stamp II used pulse width modulation. (PWM) This makes the desired output pin on the Stamp II alternate between 0 and 5 volts in a given ratio, thus producing a voltage between 0-5 volts. This current then passes through a resistor/capacitor combination to filter out the pulses and store the average voltage. Next, the voltage is boosted through an operational amplifier to give a voltage between 0-15 volts. The microcontroller can be controlled through a switch to give the desired voltage, and as a result, the desired deflection.

NUCLEAR MAGNETIC RESONANCE IN THE STUDY OF SILICA AEROGELS

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Silica aerogels are open pore materials with unique properties and are used in a variety of practical applications such as insulation. A study of their pore structure in order to determine structure/property relationships would lead to increased reliability. The purpose of this project was to determine the pore size of aerogels by measuring the mean free paths of probe molecules; xenon gas was used. Equations have been derived for describing the correlation between pressure and mean free path of a gas in an aerogel. In our case, pore size and porosity were calculated from the diffusion coefficients of xenon gas in free space and occluded xenon in aerogels determined from NMR. NMR values were compared to porosities found using BET calculations, and were consistent with deformation of aerogels during characterization by BET. Hence, porosities determined using diffusion coefficients ultimately confirmed the equations derived by Zeng, et. al. However, the calculations assume a spherical model for aerogel pores while aerogels, in fact, exhibit a fractal pore structure. Further investigations shall include determining pore size using more representative fractal and cylindrical pore models.

IMMUNO PEROXIDASE STAINING FOR THE DETECTION OF ANTIBODIES AGAINST THE SV40 T-ANTIGEN

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From 1956-1963, polio vaccines contaminated with Simian Virus 40 (SV40) were given to the human population [B.H. Sweet, et al., Pro. Soc. Exp. Biol. Med. 105, 420(1960)]. As a result, people who received SV40 contaminated polio vaccines developed SV40 neutralizing antibodies [P. Gerber, Pro. Soc. Exp. Biol. Med. 125, 1284(1967)]. SV40 is oncogenic in rodents. Recently, SV40 fingerprints have been found in several human tumors. The oncogenic viral protein is the T-antigen. Our goal is to test serums of patients for antibodies against the T-antigen and to determine if any correlation exists between the presence of the antibodies and the development of the cancer. For this purpose, we will use the immuno peroxidase staining technique. The serums will also be tested using the enzyme-linked immunosorbent assay (ELISA) and the plaque neutralization assay. A combination of these three techniques can provide us with detailed information about the status of SV40 infection in the patients.